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COAL AGE

JUNE, 1961

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HUL-E-MUL

FIRE-RESISTANT HYDRAULIC FLUID

outsells combined competition 10 to 1 in providing 100% fire-resistant hydraulic lubrication for mines

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lubrication cost in
draulic oil. Perf
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BOX SCORE

Mines using Hul-E-Mul 100% hydraulically . . 12

Other mines partially using Hul-E-Mul 56

Hulburt

OIL & GREASE COMPANY

Philadelphia 34, Pa.

Specialists in Quality Lubricants for the Coal Mining Industry

KENTUCKY RIDGE COAL COMPANY

PRODUCERS OF CROCKETT COAL

FIELD, KENTUCKY

FRED T. LOVING, JR.
GENERAL MANAGER

LESTER CHITWOOD
GENERAL SUPERINTENDENT

April 24, 1961

Hulburt Oil & Grease Company
Trenton and Castor Avenues
Philadelphia, Pennsylvania

Gentlemen:

We began changing over to Hulburt's Hul-E-Mul during Miners vacation in 1960, and have used Hul-E-Mul 100% or in all of our hydraulic mining equipment since September 1, 1960.

Prior to our switch to Hul-E-Mul we were using premium quality conventional hydraulic oil. When we switched to Hul-E-Mul our only reason for doing so at the time was for the additional protection for our men, mine, and equipment that is offered by the flame resistant properties of Hul-E-Mul. By using Hul-E-Mul our oil consumption has been cut to the extent that our cost of Hul-E-Mul is approximately 45% less than when using conventional hydraulic oil. This includes the cost of using Hul-E-Mul for flushing the conventional hydraulic oil from all of the equipment twice.

We have had less hydraulic pump and motor failures with Hul-E-Mul than we had with conventional hydraulic oil, and the overall performance of our equipment has been excellent.

We buy Hul-E-Mul in 55 gallon drums and store it outside. We have not had any storage problems regardless of weather conditions.

Realizing from experience the dangers of underground fires, especially those fed by oils, we feel that Hul-E-Mul is a very necessary and inexpensive form of insurance against same. Considering this and the savings on oil costs, and equipment repairs, we could do nothing but recommend Hul-E-Mul very highly to anyone considering its use.

Yours truly,

Fred T. Loving, Jr.

B.F.Goodrich tires haul 40-ton loads of coal to feed a freight train

HAULER FINDS B.F.GOODRICH CP COMPOUND WEARS TWICE AS LONG AS OTHER MAKES

TIME was when razor-sharp rocks and "red dog" on the haul roads at Skygusty, W. Va., ran tires ragged in only 4 months. Tire costs spiraled on the 33 dump trucks operated by Bunch Construction Co. Then the company tried retreading with B.F.Goodrich Cut Protected compound Rock Service tread. These tires have now been in service *eight* months and still have much more tread to go!

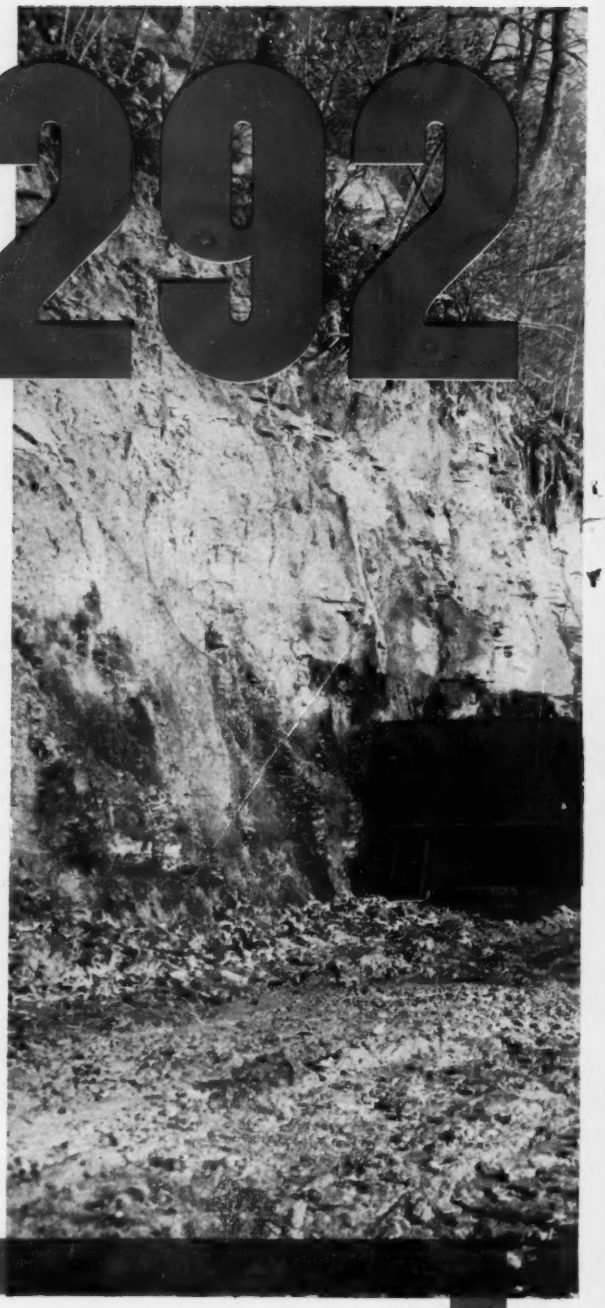
If your tires operate in rock, investigate B.F.Goodrich Rock Service tires. You'll find new BFG-developed CP compound shrugs off costly rock cutting, chipping and peeling. You'll find the B.F.Goodrich Flex-Rite Nylon cord construction resists impacts and bruises *twice* as well as conventional materials. Heat blowouts and flex breaks are practically nil. And more tires can be retreaded (Bunch Construction reports Rock Service retreads wear as long as Rock Service original treads).

If your job is as tough as this one (hauling coal 72 hours a week up and down grades as steep as 30%), it will pay you to see your B.F.Goodrich dealer. He'll show you how B.F.Goodrich Rock Service tires with CP (or Heat Resistant or Regular) compound can save you big money. Your dealer is listed under Tires in the Yellow Pages. See him today. *The B.F.Goodrich Company, Akron 18, Ohio.*

Specify **B.F.Goodrich Tubeless or tube-type tires when ordering new equipment**

144,292

IN ELEVEN MONTHS



This big McCarthy Auger mined 144,292 tons in eleven months in east Kentucky. That's bigger tonnage than many 100-man underground operations produce. And it was done with a two-man drilling crew!

Two big facts loom large in tonnage like this:

RUGGED CONSTRUCTION AND OUTSTANDING DESIGN which hold downtime to a minimum. . .

HYDRAULIC JACKS AND SKIDS which move the auger from hole to hole. No need to wait for the 'dozer.

The only time drilling slowed up was when haulage roads became impassable. The big drill works under almost "swamped" pit conditions. Pits can be as narrow as 30 feet. Highwalls can curve in or out. Coal of any density can be drilled with ease. Recovery rate is the best in the field!

If you'd like FACTS and FIGURES on the cost of augering, with a McCarthy, write directly to us or contact your nearest Salem distributor. Initial investment is less; pit-to-pit moves faster; set-up quicker. What's more . . . you can switch auger sizes at no added investment.

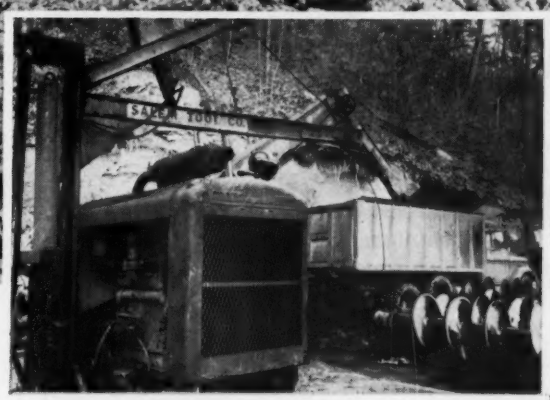
Add it up . . . augered coal costs less with a McCarthy!

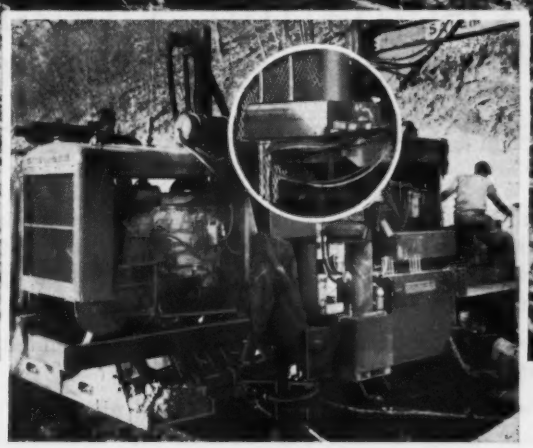
RUGGED AUGER works tight against the face. Operator can see entire highwall and observe rapid flow of coal. Only two-man crew required.

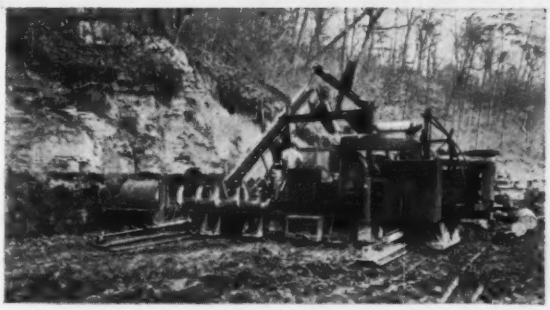
SALEM TOOL COMPANY

763 SOUTH ELLSWORTH AVE. • SALEM, OHIO

TONS



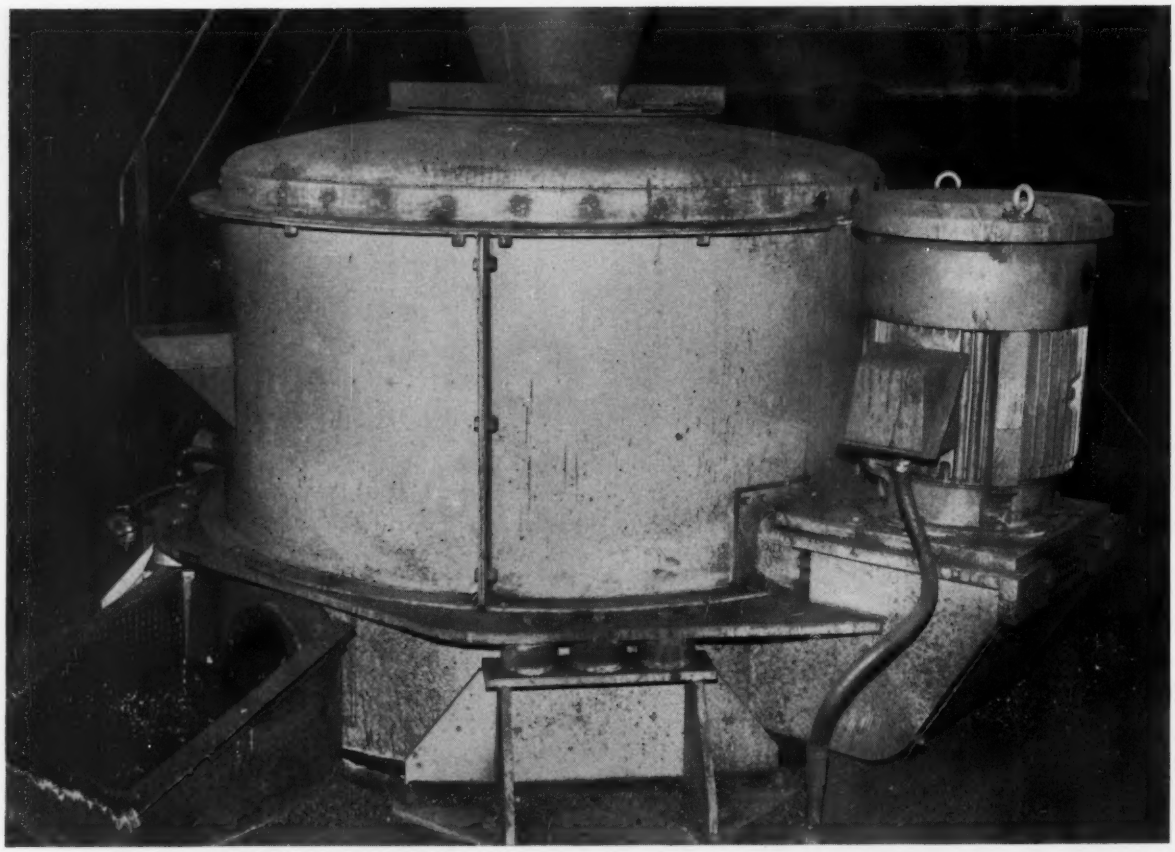




POWER-LADEN diesel engine travels smoothly on cam rollers. Advance and return are fast. Side boom has hydraulic lift and swing. Drill has low center of gravity. (ABOVE)

MODERN AUGER MINES utilize two-way radio. Big tonnages made possible by powerful McCarthys have boosted auger mining into big tonnage, high-profit class. (TOP RIGHT)

EXTENDED SKIDS smoothly position drill without 'dozer help even in sloppiest pits. Auger moves forward, back or to either side under own power. (RIGHT)



This **BIRD-HUMBOLDT** Oscillating Screen **CENTRIFUGE** Dewatered 275,000 Tons of Stoker Coal before its Screen needed replacement

Joanne Coal Company, Rachel, W. Va., ran this Bird-Humboldt Centrifuge for 4200 hours (two shifts per day for two years with an average throughput of 65 tph) before replacing the original screen.

Cost of repair parts other than the screen amounted to about *a tenth of a cent per ton.*

The Bird-Humboldt delivers this coal at only 2.5% average surface moisture. Last winter they had no complaints about coal freezing in the cars. This summer they won't be accused of shipping excess water.

For sturdiness of construction, low cost of operation and maintenance, high recovery, high capacity and thorough dewatering — whether on stoker size or $\frac{3}{8}$ x 0 — the Bird-Humboldt is your best buy. Write for Bulletin.

BIRD MACHINE COMPANY

SOUTH WALPOLE, MASSACHUSETTS

BUILDERS OF THE COMPLETE LINE OF SOLID-LIQUID SEPARATING EQUIPMENT

Operators of the **Bird Research and Development Center** for pilot-scale testing to determine the correct equipment for the job. Yours to use.

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June, 1961

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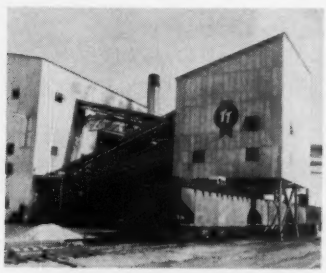


Stripping, Preparation

Truax-Traer Off to Fresh Start In Southern Illinois . . p 72

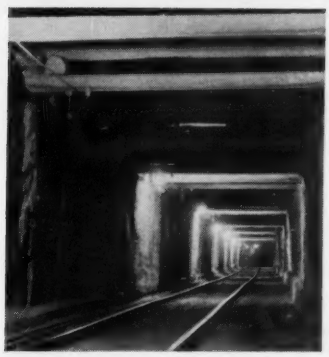
Burning Star No. 2, Truax-Traer's newest property at Pinckneyville, Ill., features a 1,200-tph preparation plant in which materials are transported solely on belt conveyors. The McNally-Pittsburg plant includes twin units for washing, crushing and sizing, thermal and mechanical drying. A 65-cu yd Marion 5761 shovel, "The Big Dipper," now is being erected to take over primary stripping duty. The loading shovel, a Marion 181-M, swings a 14-cu yd dipper, reportedly the largest in coal-loading service.

Transportation

Operating Experience With Underground Diesel Equipment . . . . . p 78

Engineering and Operating Staff, Ore Mines and Quarry
Tennessee Coal & Iron Div., U. S. Steel Corp.

Hazard reduction is one of the major benefits of the use of diesel-powered equipment in the underground iron ore and limestone mines of the Tennessee Coal & Iron Div., U. S. Steel Corp., Fairfield, Ala. On the production side, dieselization is changing the mining picture dramatically. Proper recognition must be given to the problems of diesel equipment, but TCI finds that the advantages far outweigh the disadvantages. Diesel units are a major factor in obtaining increased tonnages at a lower cost with increased safety in TCI ore mines. The increased flexibility of shuttle-car operation has made possible a number of changes in mining layouts.



Mine Lighting

Good Lighting . . . What It Means in Coal Mining . . . . p 84

Contentment with today's lighting facilities, especially in the face area, reflects basically lack of realization of the cost effects of illumination on both safety and productivity. In one of the earliest attempts at lighting up a working section, the section had no accidents in 2 yr, compared to 1, 2 and 5 for other sections. Production in the lighted section averaged 33.8 tons of material per man-shift. In the unlighted sections it ranged from 21.2 to 28.9 tons per man. Equipment is now available for good lighting of both working sections and other mining areas. Investment in face-lighting facilities probably would be less than $1,000 per place for a 4- to 6-place section.

(Continued on p 7)

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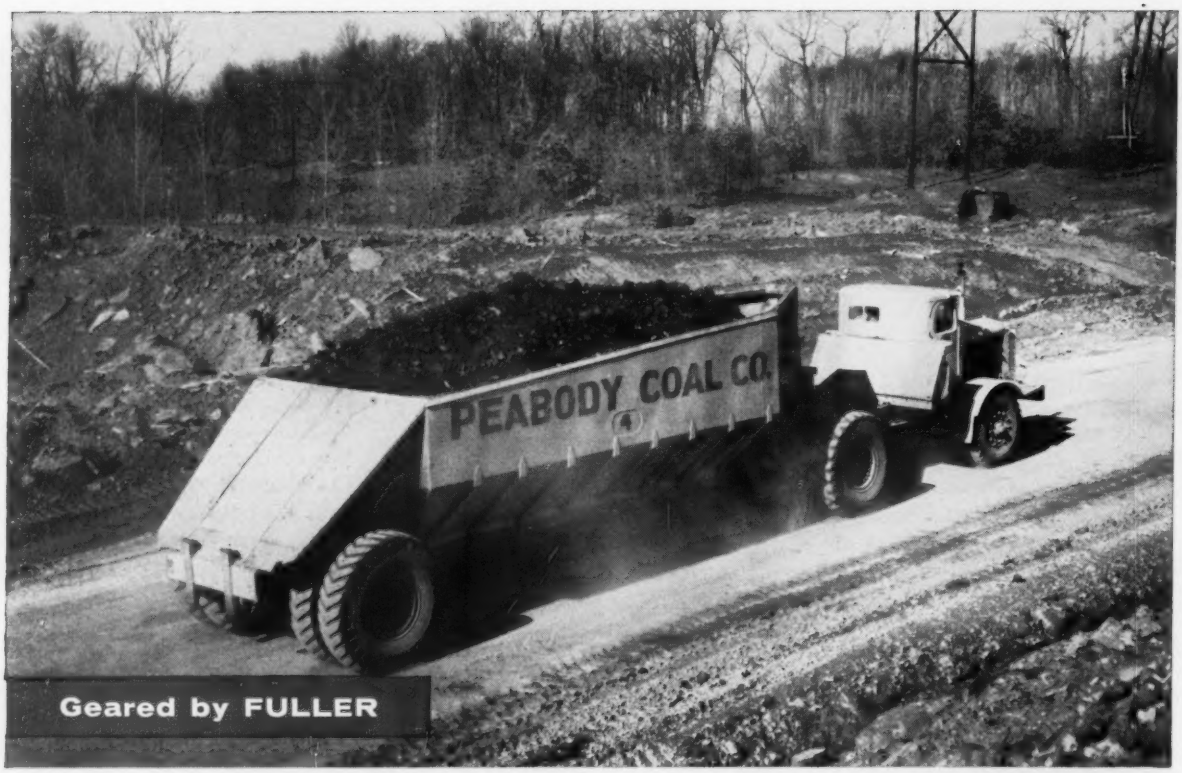

Peabody Coal Company of St. Louis, Missouri hauls 52-ton loads from their River King Mine in Illinois with *Fuller-equipped* Model 129TDT Euclid Tractors. These ten Euclid Tractors pull Model 124 Wagons with 61 cubic yard capacities. Engines in the Peabody Euclids are Cummins 350 hp V8 and NRTO 330 hp diesels and 12V71 336 hp Detroit Diesels. All drive through Fuller R-1160 ROADRANGER Transmissions and 14.96:1 axles.

Designed for Coal Hauling Equipment

Model R-1160 ROADRANGER Transmissions

Faster, smoother operation, greater fuel economy, faster cycles, and longer gear and bearing life are offered by the Fuller R-1160 ROADRANGER Transmission.

Check these advantages:

- No gear splitting—nine selective ratios evenly and progressively spaced (average of 38% steps).
- Easier, smoother shifting—one shift lever controls all nine forward and two reverse speeds.
- Pre-selected range shifts — automatic and synchronized, with range selector located on the shift lever.
- Quicker up shifts for constant operation in peak horsepower range — assured by Fuller air powered countershaft inertia brake.
- Prolonged gear and bearing life—Pressure Lubrication and Filtration System provides positive lubrication and maintains clean lubricating oil to prolong gear life.

Gear	Ratio	% Step	
9th	.75	33	
8th	1.00	39	HIGH RANGE
7th	1.39	40	Reverse 3.31
6th	1.94	34	
5th	2.59		
RANGE SHIFT			
4th	3.48	39	
3rd	4.84	40	LOW RANGE
2nd	6.76	34	Reverse 11.53
1st	9.02		

Weight: 1133 lbs. Length: 44 21/32"
Clutch Housing Size: SAE No. 1
Oil Capacity: 35 pts., w/filter 38 pts.
Approximate Engine Size: 1160 cu. in.

FULLER TRANSMISSION DIVISION
EATON MANUFACTURING COMPANY
KALAMAZOO, MICHIGAN

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Preparation

Sidney Katell and Thomas J. Joyce, USBM

What Pulverizing Costs . . . . . p 92

Many coal-utilization or transportation applications being developed or already in service are based on grinding coal to 70 to 90% through 200M. Various equipment units available include hammer and ball mills. These were studied by the USBM to determine commercial-scale costs of using them to pulverize to the desired fineness, assuming a 55 Hardgrove and 4% moisture. Using the hammer mill for the first reduction to minus ¼ in, estimated costs are (without return on capital investment): 50 tph, 70% through 200M, $1.10; 250 tph, $0.53 per ton. Pulverizing to 90% would add $0.05 per ton.

Markets

Utility Coal in 1965 . . . 63-Million-Ton Increase . . . . . p 94

The average increase in use of coal by electric utilities is expected to be 12 million a year for the next 5 yr, with a total increase of 36% in 1965 over present consumption, according to the 8th annual *Keystone Coal Buyers Manual* survey. By 1965, it is predicted, coal will be burned in all but five of the 50 states of the Union. This will result from the fact that gas and oil are losing the competitive battle, not only in established coal-burning territitories, but in areas where they previously had been kings. And coal's potential also is increasing in Canada with the initiation of the coal purchases for new steam stations by the Ontario Hydro Commission.

Maintenance Ideas

What You Can Expect From Fire-Resistant Fluids . . . . . p 98

What are your chances of using fire-resistant hydraulic fluids successfully and what economic advantages or disadvantages can you expect from these fluids? Some light on this subject has been shed by David H. Michael, general manager, Hulburt Oil & Grease Co., in a paper presented at the 1961 spring meeting of the West Virginia Coal Mining Institute.

Get to Know Your Service Shops Better . . . . . p 99

Rising maintenance costs have prompted management to take a second look at custom service shops. They are looking for shops that provide quality workmanship, charge reasonable prices and give good service. If they cannot find them they will set up their own facilities.

(Continued on p 9)

This Month in COAL

UPTURN AT LAST—It is now evident that the week ended March 11 marked the end of the 1958-61 depression in bituminous coal production. Output in that week was 6,130,000 tons—the lowest in any except a vacation week in the 2-year-plus period of reduced tonnage. From that cellar figure output quickly surged up through the 7-million-ton level and headed for 8 million plus, and possibly 9 million or so, by the end of the first half. For the second half, the course of business will tell the tale. But it can be assumed that the business comeback will strengthen in the second half, though "assumption" possibly still should be emphasized. If business does gather strength, the 9-million-ton rate quite likely can be maintained and perhaps even improved upon occasionally, leading to the further conclusion that a total output equal to or better than 1960 is a good bet.

Anthracite's upturn, reflecting the cold winter and spring, continued through April and into May, though the remaining months of 1961 may be a different story. But in the early months, at least, anthracite enjoyed the first increase over the previous year it has experienced in a long, long time.

CAPITAL SPENDING—A basic reason for anticipating strengthening in business recovery is the continued high rate of spending planned for new plants and equipment. The 14th annual McGraw-Hill survey of expenditure plans shows that the 1961 level will be only 1% under 1960 and, at $35.35 billion, only $1.6 billion under the 1957 peak. Advance plans for 1962-64 indicate levels as high, even now, as the total for 1961. To sum up, business expects a rise in activity and is planning accordingly.

BIGGER AND BIGGER—The upturn in coal production may save the UMW from a choice between two alternatives, neither calculated to contribute to peace of mind on the part of union officials. In fact, it could happen in spite of the upturn. The alternatives are: (1) some concessions to keep remaining union signatories in certain major areas in Pennsylvania, Kentucky, Tennessee and elsewhere from closing down or going nonunion, or (2) another expensive and probably futile attempt to knock over the nonunion producers. In fact, no matter what the course of business, this nonunion tonnage is going to become a bigger and bigger headache in relations between the UMW and the commercial operators it has contracts with.

NEXT COMPETITIVE BATTLE?—An increasing number of reports of feeding oil and gas into the reaction zones of blast furnaces leads to the conclusion that this may be one of the next big battles between the fuels, since pulverized coal also may be used—and is. Again, the result may turn on the prices at which oil and gas are offered vs. the cost of coal pulverized at the furnace ready for feeding. Some 20% or so of the blast-furnace coal tonnage may be at stake, but coal's chances are not necessarily poor.

CONTINUED FERMENT—The transportation picture continues to boil and bubble in the U.S., with developments in almost every case favorable to coal. Combined rail-river-canal-rail, or rail-collier movement to the West Coast is expected to be a reality for a significant eastern tonnage before many more months, while in the big producing and consuming areas east of the Mississippi the rails and waterways continue to seek ways of holding coal markets and traffic by rate actions. And new pipelines always remain a possibility. In fact they might be considered more than a possibility.

NEW Completely Transistorized M-S-A® Model E-60 MinePhone®

Here's the first mine communications system fully protected against power failure

Power failures can't knock out the rugged M-S-A E-60 MinePhone.

Always operative, power comes from the storage battery, on constant charge from the trolley. Takes only *one watt* of battery energy to ready the MinePhone for standby transmission or reception. In event of power failure, you still have hours of service from the fully charged battery. As power is restored, battery is automatically recharged.

The compact transistor makes possible a 35% reduction in size of this new transmitter/receiver. There are no vacuum tubes to wear out. No damage due to vibrations.

Consider these safety factors: the E-60 MinePhone — needing no warm-up period — permits instant reporting of hazardous mine conditions. Scheduling is more efficient. And in case of emergency you can alert both surface and mine personnel — keep them tuned in — even when trolley power is off.

You can realize an impressive pick-up of movements from face to tipple, too. More trips per shift without costly traffic tie-ups. Improved control and distribution of mobile equipment. No unnecessary starting and stopping.

Your MSA representative would be pleased to discuss your actual communication requirements. Call him soon. And write us for free product data bulletin. Mine Safety Appliances Company, Pittsburgh 8, Pa. In Canada: Mine Safety Appliances Co. of Canada, Ltd., 500 MacPherson Ave., Toronto 4, Ontario.

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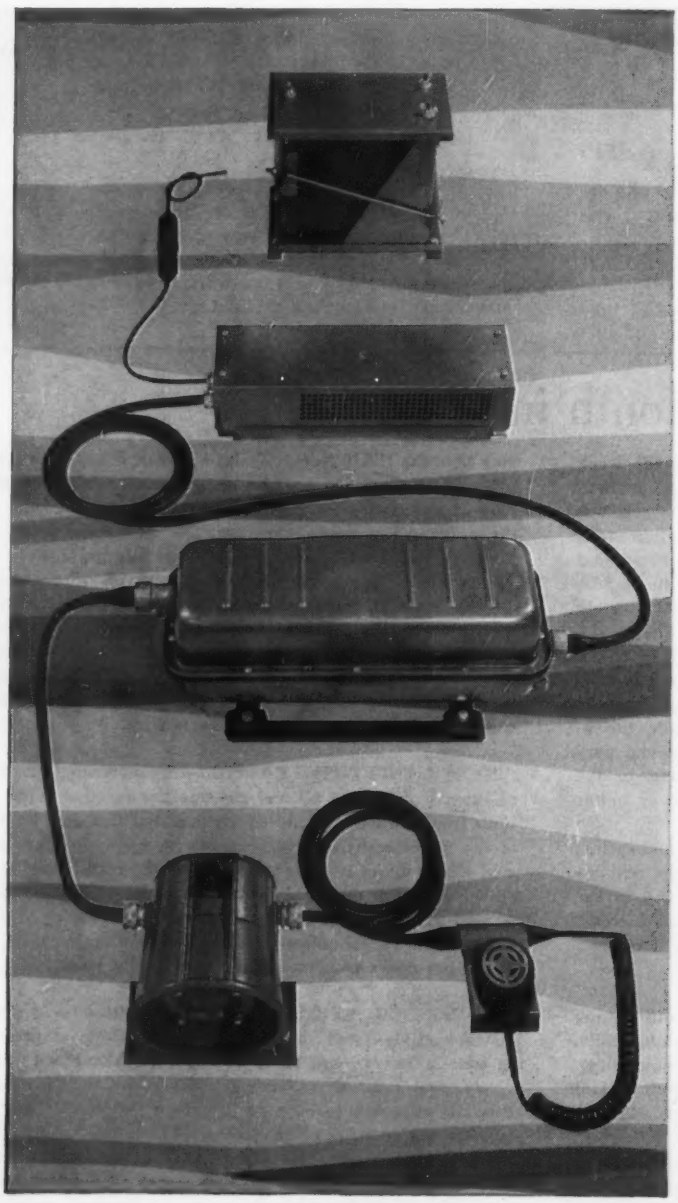

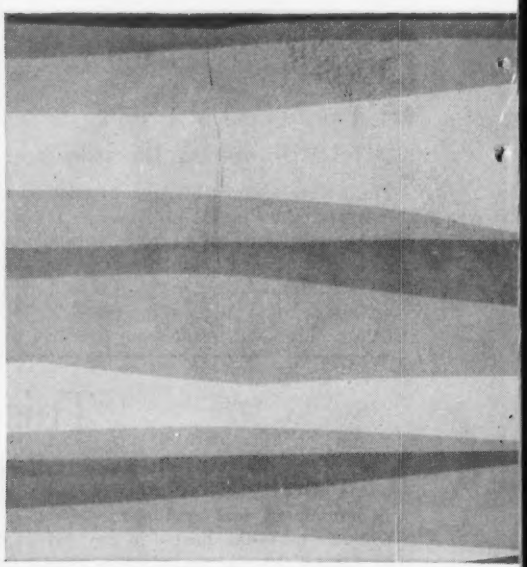

Industry Meetings

Mine-Tested Methods . . . . . p 108

Review of proceedings at technical sessions of the American Mining Congress Coal Show at Cleveland provides numerous ideas for raising efficiency and reducing costs. Main topics: Continuous mining, conventional mining, stripping, coal preparation, haulage and power, management and cost control, safety and new properties. The speakers: 40 top managers and operating executives, many of them reporting operating results from their experience with and study of new equipment.

West Virginia CMI . . . . . p 118

Continuous mining, heavy-medium cyclone washing, bulk handling of rock dust and flame-resistant hydraulic fluids were major topics. Spring meeting was held at Mont Chateau Lodge, Morgantown, W. Va., April 21-22.

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THIS MONTH . . . in Mining Practice

BOLTING PROGRESS—For 1960, the USBM reports, 564 mines (up 34 from 1959) were bolting roof and 57% of the underground production came from under top protected in this manner. An average of 3,137,443 bolts were installed per month by these mines for an average output of 13,555,793 tons, or 4.3 tons per bolt.

Reclaimed bolts installed, averaged 232,008 per month, or 7½% of the total. Whether the average consumption per ton can be reduced remains an unanswered question. The bureau, however, proposes a new technique to arrive at the optimum bolting pattern, which might result in savings in some instances, though of course not in all. Essentially it involves overbolting, then removing bolts selectively by blasting off the nuts and measuring sag, strain and bolt load. The method is said to be applicable to "most bolted roofs and for most mines."

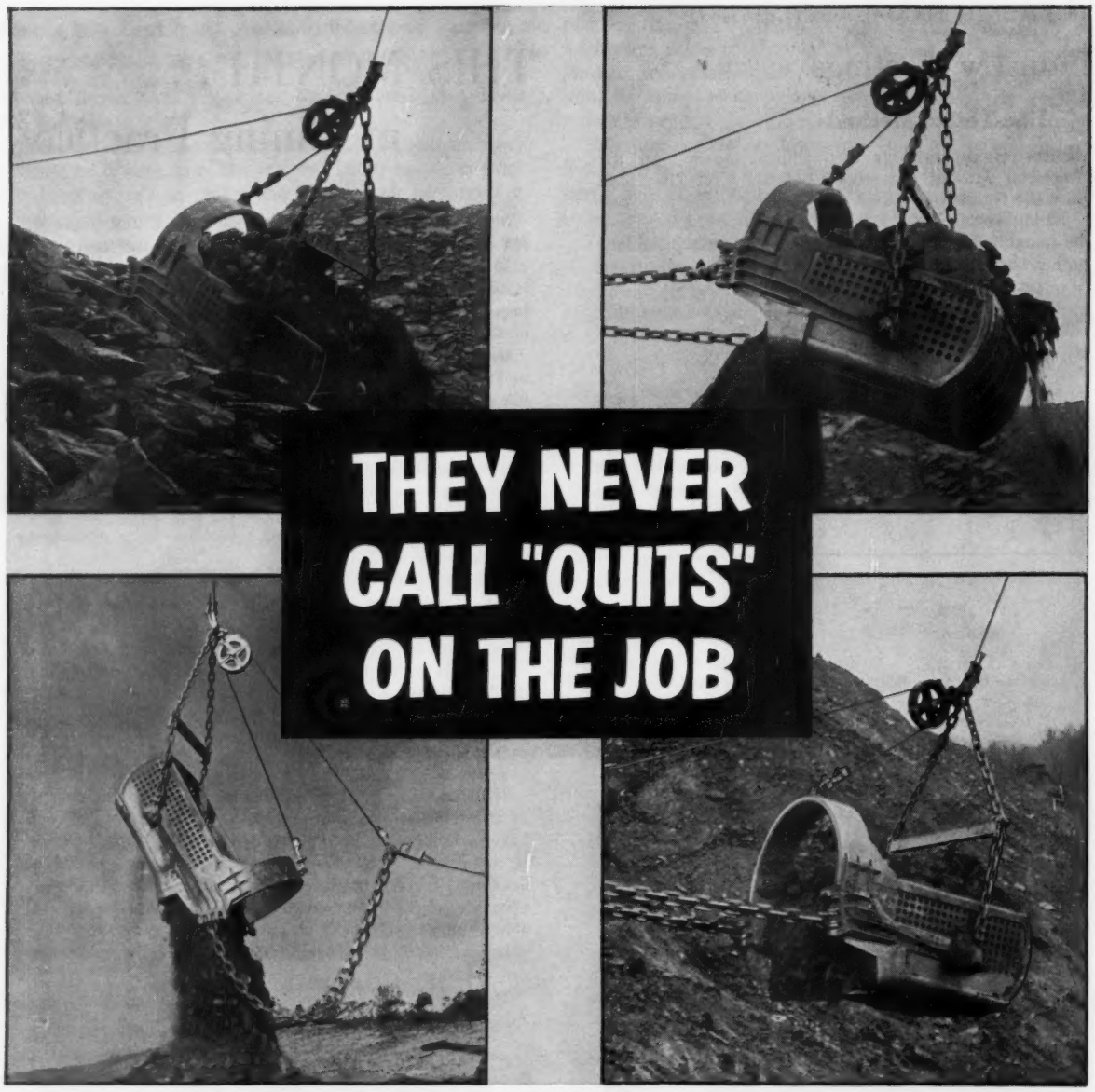
Russian Footnote—Support is a major problem in Russia, too, as it is anywhere mining is done. The Russian government recently awarded the Lenin Prize to a group of designers and mining engineers for a mechanized prop system that is claimed to have doubled output where applied in the Kuznetz, Irkutsk, Primorye and other fields. (A prize also was awarded for mechanized champagne production—not to miners, incidentally.)

SIZING WITH DRYING—Air classification of materials by size fractions is an old technique. Its applications in coal have included, in days gone by, dedusting in the production of stoker coal. Now, it is proposed, and a system has been developed for the purpose, to take advantage of the basic principle of the fluid-bed dryer to size at the small end along with drying. If the idea works out in practice, a new sizing unit will be available in classifying the wet fines and ultrafines.

ULTRASONIC CLEANING—One of the really dirty and consequently—in many instances—inadequately done jobs in maintenance is cleaning parts and equipment. This does not mean that equipment, such as, solvent tanks and steam cleaners, is not available—rather that it is not employed as it should be. Now, ultrasonic cleaning, or loosening and removing the dirt by sound waves, has been developed. Preliminary reports indicate that it can be another useful tool in the unglamorous but necessary cleaning step in maintenance and rebuilding.

FIRE-RESISTANT FLUIDS—As yet the number of mines completely on fire-resistant hydraulic fluids still is only 10 to 12. All are using emulsions. Results have included an actual reduction in cost of fluid in many instances. Secrets of success include not only the fluid itself, but also careful attention of application, use and service, especially in the initial stages.

SEED TOO—To the cash crops flowing out of stripping and subsequent reclamation must now be added income from seed sales. One company is experiencing a brisk demand for crown-vetch seed, in wide use for stabilizing road cuts and the like. It has turned out to be a forage crop, too.



THEY NEVER CALL "QUITS" ON THE JOB

"HENDRIX"

Heavy Duty Mining Buckets

4½ to 40 Cubic Yards With or Without Perforations

HENDRIX MANUFACTURING CO., Inc.

MANSFIELD, LOUISIANA

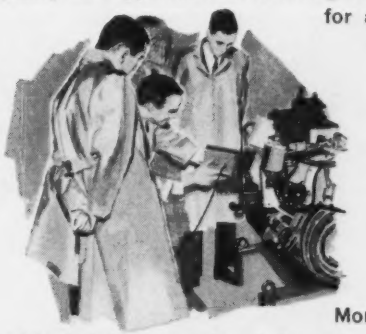
HIGHER ARCH · WIDER FRONT · TRI-TAPERED BASKET · GREATER STRENGTH

This is AMERICAN OIL COMPANY

Our organization has more than 70 years' experience in the oil business. We are one of the largest petroleum organizations in America.

We believe the experienced American Oil representative who calls on you, plus the products and facilities which he has at his disposal, are reasons why you will like to do business with us.

Your American Oil representative receives special training for his job at our Sales Engineering School. He is given concentrated basic instruction in all phases of petroleum product quality and application. According to a planned schedule, he returns for an advanced course and then again for post-graduate work.

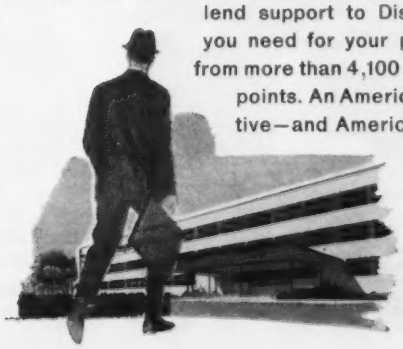


In our Marketing Technical Service Department are specialists who are recognized authorities in their fields. These senior consultants may be called in to work with you on any specialized problem.

More than 1,000 research scientists and technicians are at work in our research laboratories developing new products and finding ways to improve present products. Their mission: To help your American Oil representative help you lower your maintenance costs and stretch your maintenance dollars.

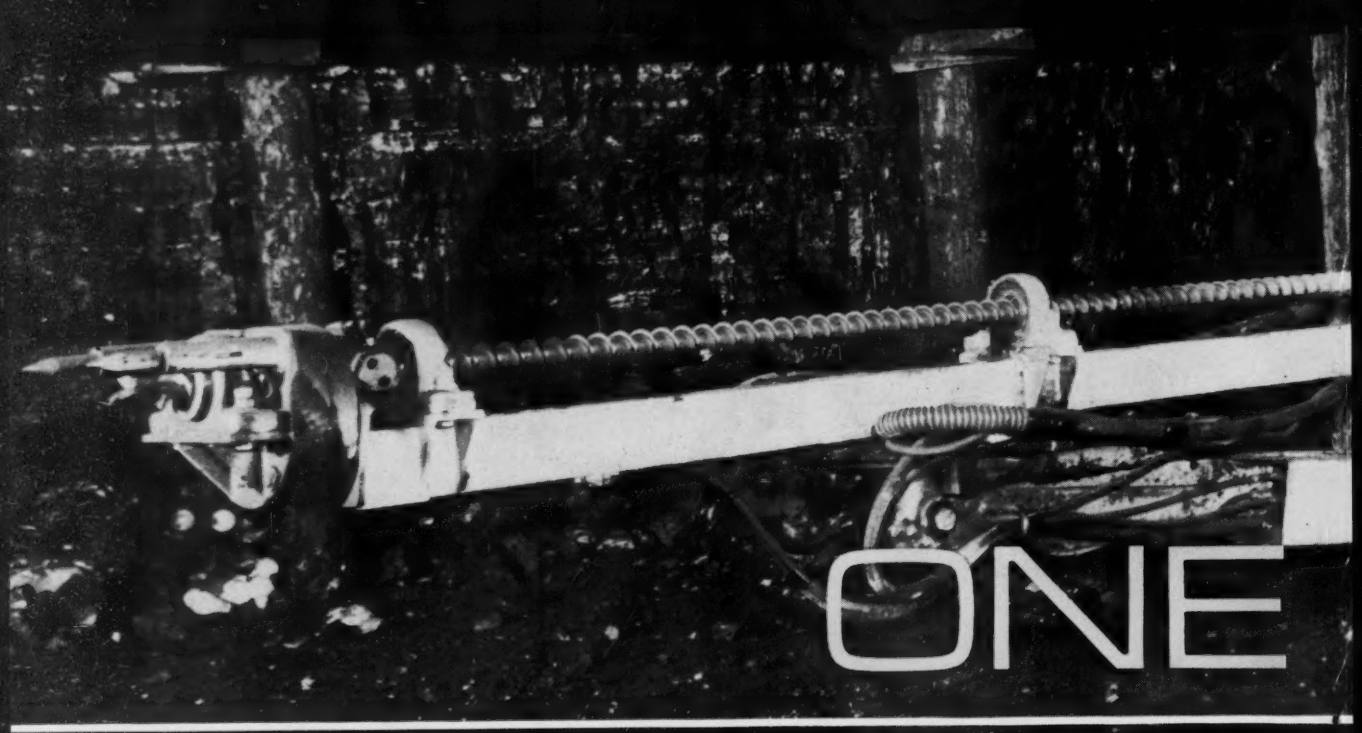
Twelve American Oil refineries give flexibility to the production of petroleum products for industry. They help make it possible to assure prompt delivery. Upwards of 2,875 miles of product pipelines augment delivery facilities.

American Oil representatives operate from 74 District Offices. Thirteen Regional Offices strategically located throughout the country lend support to District Offices. The products you need for your plant or fleet are available from more than 4,100 warehouses and distribution points. An American Oil Company representative—and American Oil products—are only a telephone call from your office. We invite you to make that phone call. Or write **American Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.**

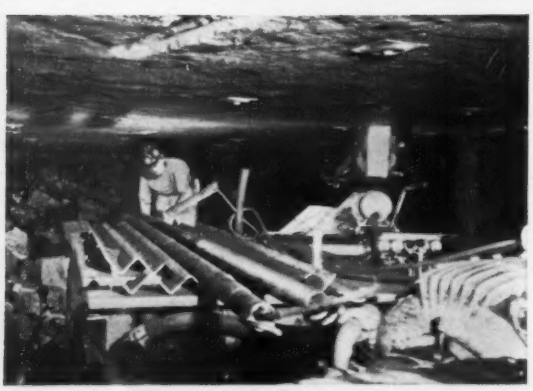


AMERICAN

AMERICAN OIL COMPANY



Single unit drilling, multiple shooting machine



This is a "standard" cycle established in a West Virginia coal mine.

Tramming (200 feet average)	2.00 minutes
Drilling	4.10 minutes
Loading Holes with Airdox Tubes	2.00 minutes
Walk to Blowdown Valve and Return	1.32 minutes
Shooting	1.50 minutes
Removing Tubes From Holes, Loading on Machine	2.00 minutes
Total	12.92 minutes

The Long-Airdox mobile drilling and multiple shooting machine makes it possible for *one man* to drill and shoot the face quickly and economically.

It is equipped with racks for carrying tubes, high

MAN...

LATER

offers fast cycle for high capacity mining systems

pressure hose, and sequence valves. Operator drills holes, inserts tubes, and shoots them in proper sequence in a single operation.

New Long-Airdox developments—the mobile coal drilling and multiple shooting machine, lighter weight automatic discharge tubes, sequence shooting of any number of holes, and others—force revision of former ideas concerning air shooting. Long-Airdox Mobile Multiple Shooting also gives you these plus benefits.

- Faster cycles—no waiting for smoke to clear.
- Better loadability—coal is heaved outward for easier, faster loading.
- Full undercut depth realized—square faces and ribs—more coal per cut.
- Especially suited to deeper cuts.
- Low cost—based on clean coal only.
- Better sizing for higher realization and less expensive cleaning.
- Coal has firmer structure—better size stability on the way to market.
- Safety.

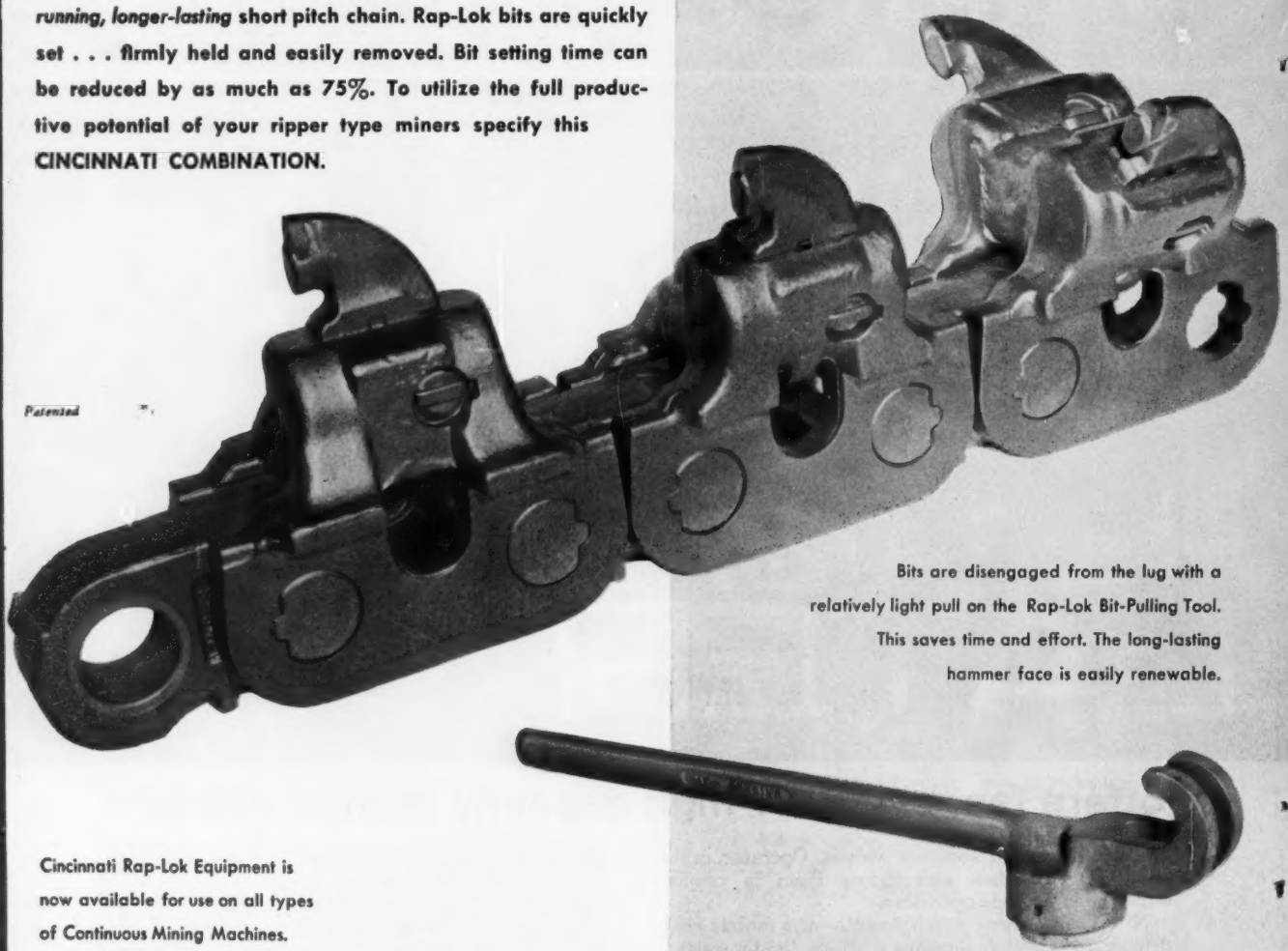
For complete details on Mobile Multiple Shooting, and for information on drilling machines for all applications, write Long-Airdox, Oak Hill, West Virginia.

LONG-AIRDOX

PROVEN "CINCINNATI" COMBINATION

THE RUGGED *SHORT PITCH RIPPER TYPE CHAIN WITH THE TIME SAVING RAP-LOCK PRINCIPLE*

THE Cincinnati "Short Pitch . . . Rap-Lok" Chain combines an entirely new concept of bit holding with the *smoother running, longer-lasting* short pitch chain. Rap-Lok bits are quickly set . . . firmly held and easily removed. Bit setting time can be reduced by as much as 75%. To utilize the full productive potential of your ripper type miners specify this CINCINNATI COMBINATION.



Patented

Bits are disengaged from the lug with a relatively light pull on the Rap-Lok Bit-Pulling Tool. This saves time and effort. The long-lasting hammer face is easily renewable.

Cincinnati Rap-Lok Equipment is now available for use on all types of Continuous Mining Machines.

THE CINCINNATI MINE MACHINERY CO.

CINCINNATI 25, OHIO

TWO ESSO PRODUCTS KEEP MINING MONSTERS CHEWING CHEERFULLY

1. NUTO® rust- and oxidation-inhibited hydraulic oil gives extended service. Provides outstanding protection against rust in hydraulic systems used in damp mine conditions. Excellent fluidity for fast start-ups at low temperatures. Maintains good body at high operating temperatures to minimize leakage and pump wear.

2. NEBULA® EP 5F a semi-fluid grease for lubricating gears, bearings, clutches and linkages. Provides extreme-pressure and anti-wear qualities. Inhibits oxidation over long service. Minimizes leakage through seals by virtue of its semi-fluid consistency, unchanged by heat or churning.

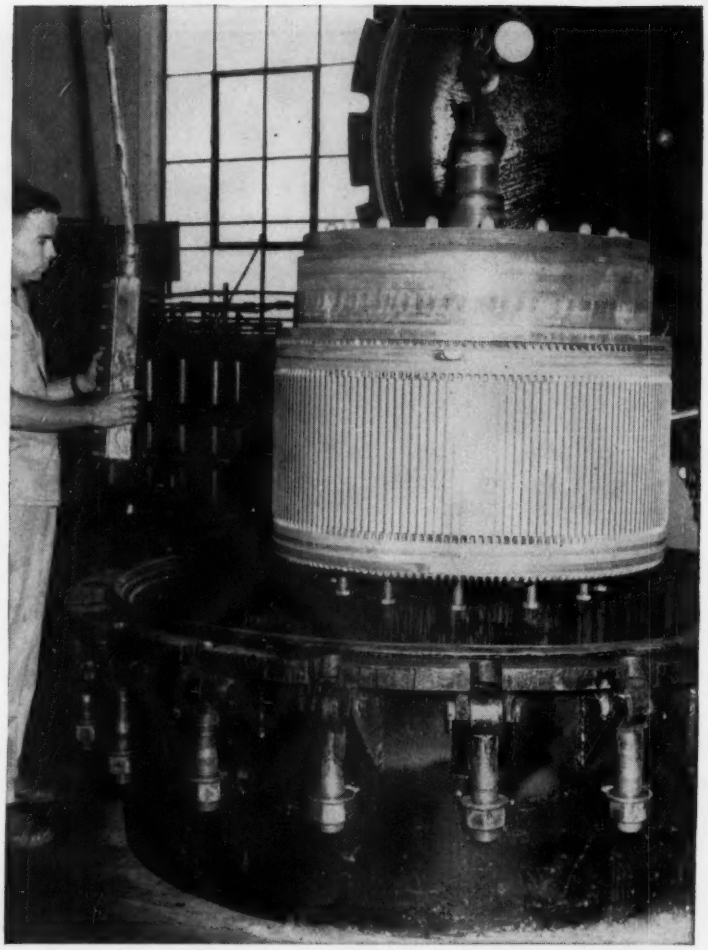
Your Esso representative can help you keep production humming with a full line of advanced fuels and lubricants. Contact him for more information, or write us at 15 West 51st Street, New York 19, New York.

ESSO STANDARD, DIVISION OF
HUMBLE OIL & REFINING COMPANY

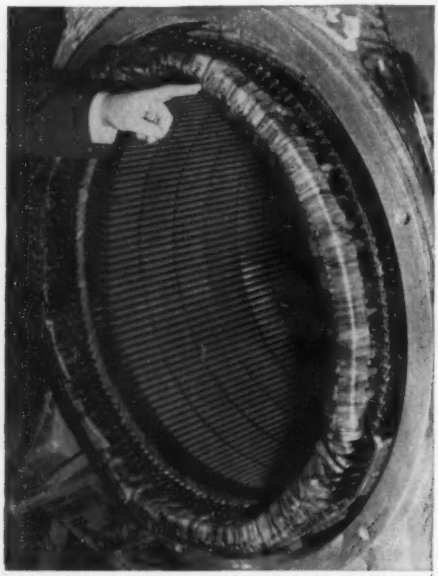
For maximum motor life...

NATIONAL VACUUM-IMPREGNATES THE COMPLETE MOTOR WITH EPOXY

National offers superb facilities for rewinding and rebuilding rotating electrical machines...such as this large vacuum tank used in impregnating insulations with super-strong Epoxy resins. Not only single coils, but complete armatures and stators from large motors and generators are regularly handled in this equipment.



Diesel electric generator armature is lowered into huge vacuum pressure tank.



Complete stator assembly with NECCOBOND insulation system, after vacuum impregnation with Epoxy resins.

This process, used with the NECCOBOND insulation system provides these assurances of maximum service life:

- the insulation wall is completely void-free, with all interstices filled with resin to provide maximum heat conductivity.
- the exceptional mechanical strength and adhesion of Epoxy resin bonds the entire winding and core into a solid mass.
- uniform encapsulation provided by National's method of baking, insures high degree of protection against moisture.

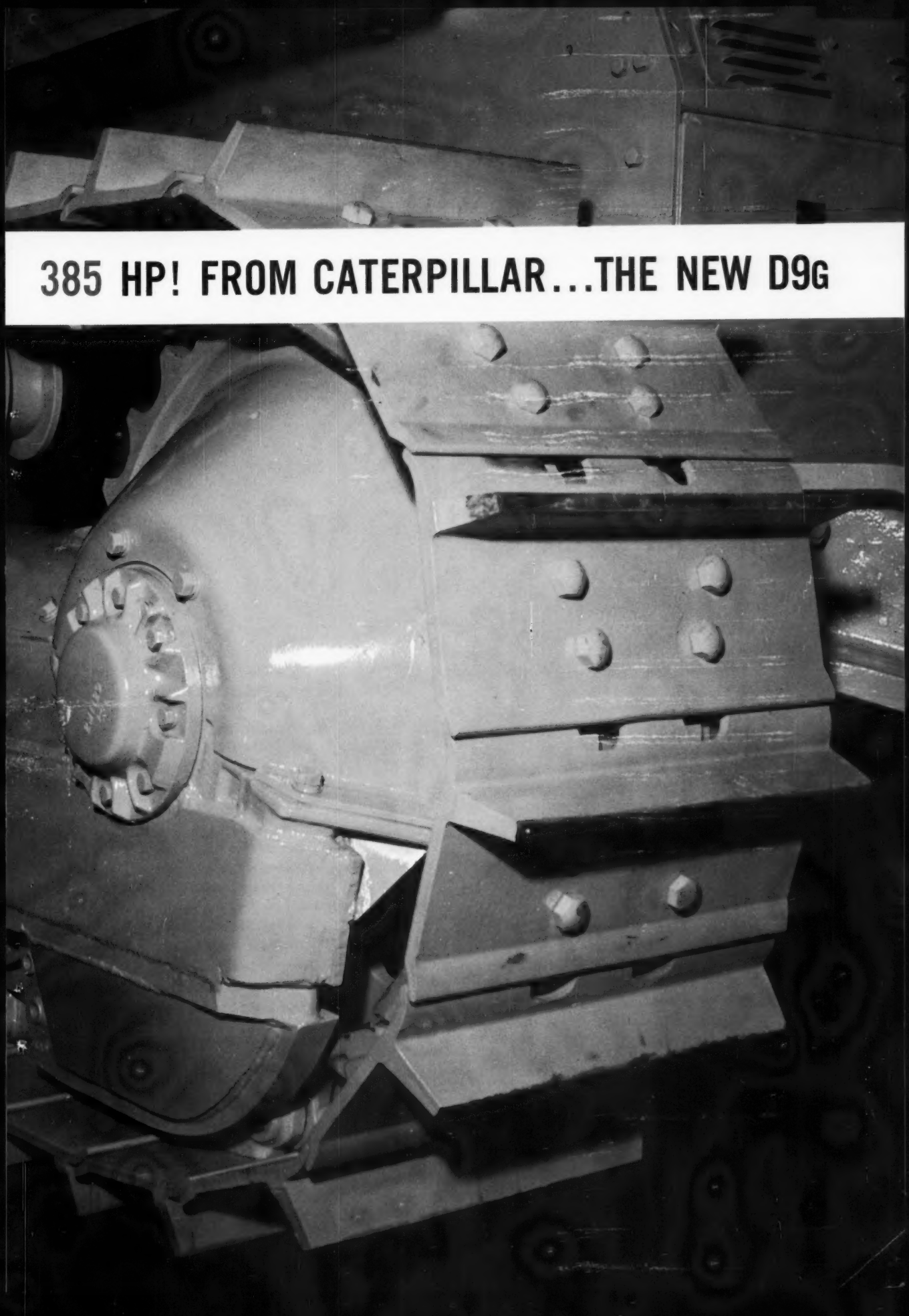
Whether your electric coil and rebuilding needs are standard or special, you'll be sure of performance when you call in National Electric Coil. We tailor-make the coils to fit your needs, offer all types of insulation. For information call National's Columbus plant ...HUdson 8-1151...or check the nearest National field engineer.

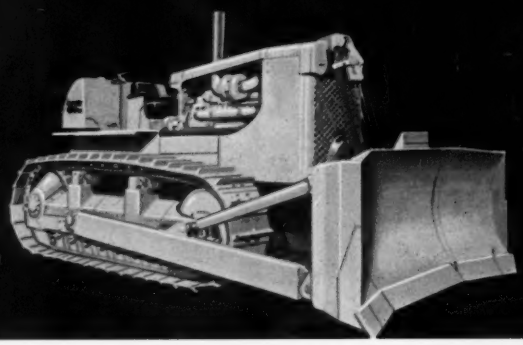
NATIONAL COILS

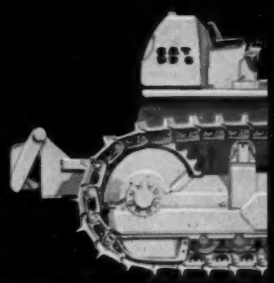
National Electric Coil

COLUMBUS 16, OHIO • IN CANADA: ST. JOHNS, QUEBEC

DIVISION OF McGRAW EDISON


385 HP! FROM CATERPILLAR...THE NEW D9G





NEW D9G: 385 HP, 64,800 LB., POWER SHIFT,

For high-volume dozing, pushloading or ripping, the new D9G has what it takes . . . at minimum cost per yard!

The engine in the new D9 delivers 385 flywheel horsepower. That's *100 more horsepower* than the first D9 introduced five years ago!

Weight: 64,800 lb.—14% more than the first D9!

Torque divider power shift transmission . . . massive heavy-duty undercarriage . . . and power train with new, built-in ruggedness for long life.

What else is new? Matching the D9G, to make best use of its power, is a full line of attachments. Cable controls, hydraulic controls, pushing equipment, dozers, rippers and others—all designed to help this new tractor really put out on the toughest big jobs.

CAT D353 ENGINE AND MATCHED POWER TRAIN

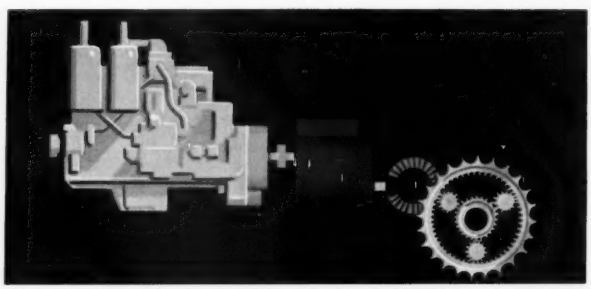
Engine: This engine, rated at 385 HP (flywheel) at 1330 RPM, has been proven over thousands of hours on the roughest jobs. Cat-built, its 6.25″ x 8″ 6-cylinder design now incorporates these new features:

• **Controlled Turbocharging**—This system, found only in the D9G among crawler tractors, automatically forces more air into the cylinders during lug. Result: increased maximum torque, fast engine response over a wide range of operation.

• **Aftercooler**—Air leaving the turbocharger passes through a water-cooled heat exchanger. Cooled air has greater density. Thus, more air can be packed into the cylinders, giving greater power output and efficiency.

• **PLUS**—Shroud-mounted fan with torque limiting clutch provides maximum cooling during lug and reduces fan-absorbed HP by 30%. Exclusive Caterpillar fuel injection system allows use of low-cost fuel. Also, twin dry-type air cleaners . . . oil-jet-cooled pistons . . . "Hi-Electro" hardened cylinder liners and crankshaft journals.

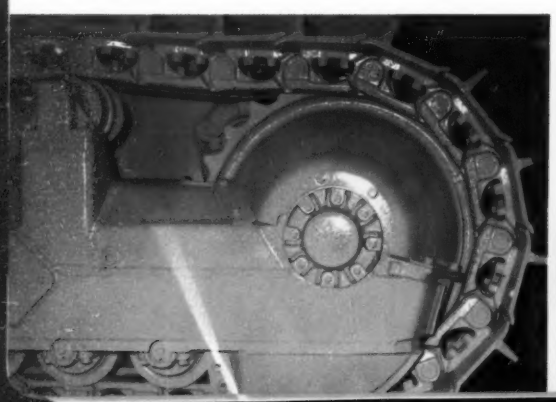
New Power Train: Major advances in the D9G's new power train include *new oil-cooled steering clutches and brakes, new planetary final drives,* and a time and cost saving *common lube system.*

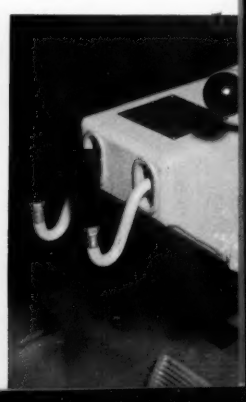


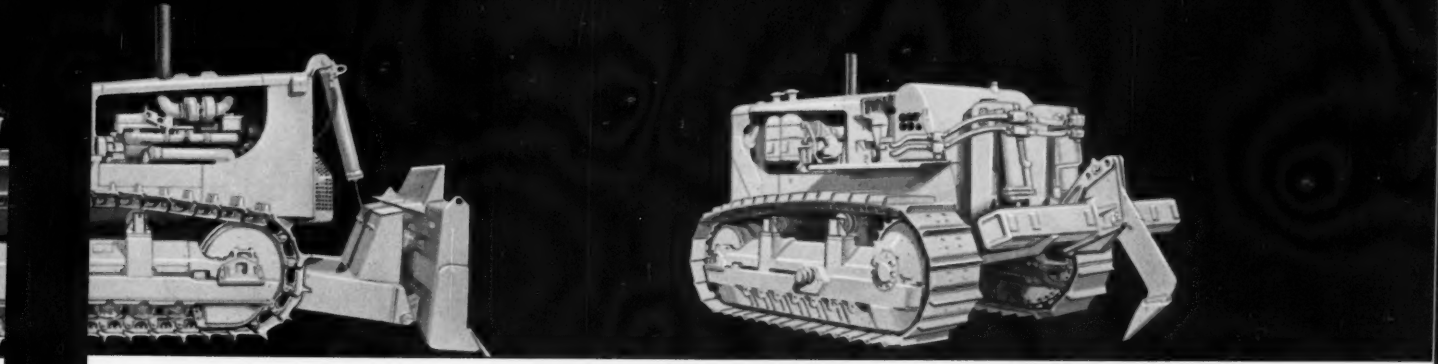
The new steering clutches, spring engaged and hydraulically released, need no adjustments. The longer service life of this type of clutch, as well as that of oil-cooled brakes, has been proven by millions of hours' use on D8H Tractors.

The new planetary final drives increase gear reduction ratios from 8.8:1 to 18:1, materially reducing torque load on all other power train components. A common system cools and lubricates torque divider, transmission, bevel gear, steering clutches and brakes. This means one service point . . . one type of oil. Final drives have their own pressure lube systems complete with pump, filter and disposable element.

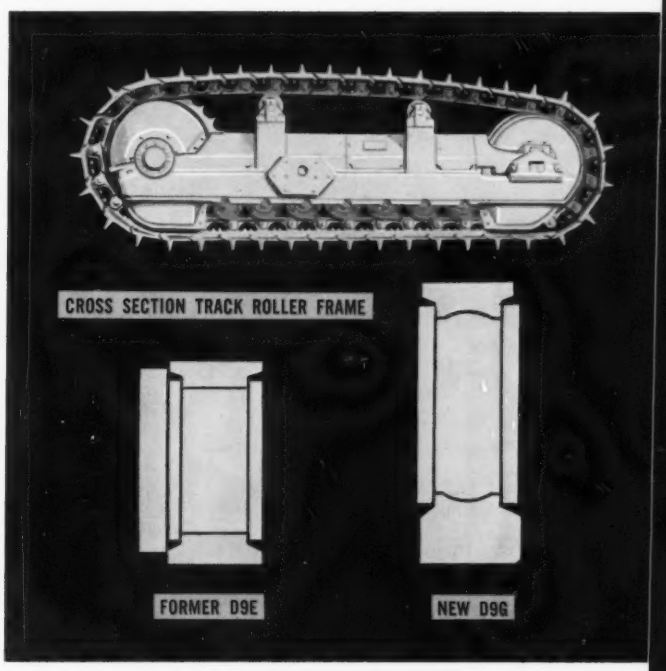
Entire power train has unitized construction for fast, individual removal of components.







HIGH-PRODUCTION DOZER, PUSHER, RIPPER



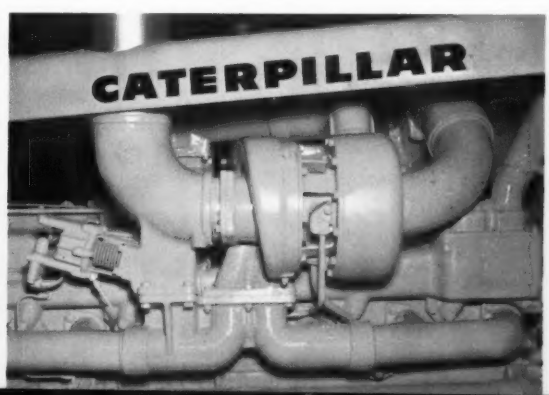
PROVEN TORQUE DIVIDER POWER SHIFT:

Standard equipment on the D9G, this exclusive Caterpillar design combines the efficiency and "snap" of direct drive with the load-matching and anti-stall characteristics of a torque converter.

A single lever gives the operator finger-tip control of his machine. It adds up to fast cycle times, less operator fatigue with greater efficiency. You get more out of the machine *all day*.

MASSIVE HEAVY-DUTY UNDERCARRIAGE:

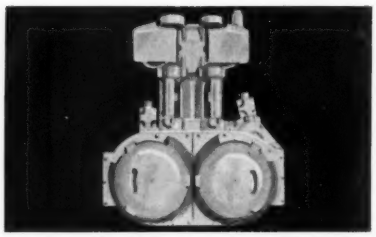
Immense strength and rigidity have been built into the D9G undercarriage to make it more than equal to the roughest ripping job. Box section frame is wider and deeper than previous models. Hydraulic track adjusters are standard. Lifetime lubricated rollers with special alloy deep hardened rims assure long life . . . and they require no servicing until rebuilt. These features give the D9G the finest big tractor undercarriage ever built.



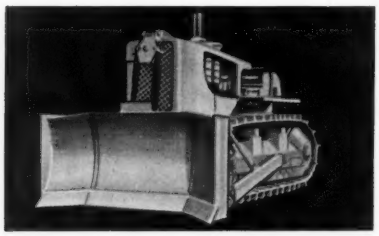
The NEW 385 HP D9G—with high-production attachments

The D9G is big . . . and, it becomes versatile, too, with the many matching attachments your Caterpillar Dealer offers. Cable controls, hydraulic controls, rippers, dozers, pushing equipment, scrapers and others help make the D9G the most productive big tractor available.

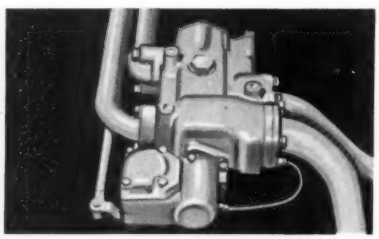
To prove the D9G's productive capabilities on your job, talk to your Caterpillar Dealer.



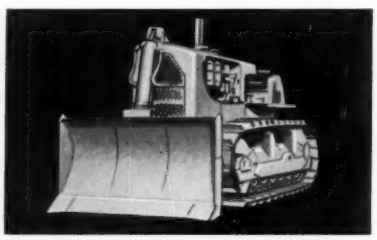
New cable controls have larger clutch, brake and drum capacities and are hydraulically boosted. Available in front or rear single drum for dozer application. Rear single drum may be converted to double drum at any time. You buy what you need.



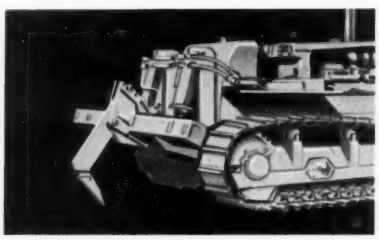
No. 9U can increase dozing production as much as 50%. Also available are No. 9A and No. 9S. Tilt cylinder can be used with U or straight blade. Choice of hydraulic or cable control for all blades. Hydraulic dozers have "quick-drop" valves.



New hydraulic controls available in nine arrangements to meet every application need.



No. 9C dozer combines dozing and cushioned pushing functions into one attachment. As a pusher, it allows 3 MPH cushioned contact. Rear-mounted cushion push block also available for tandem pushing.



No. 9 ripper—5-position clevis, selection of shanks and tips, quick-change features adapt No. 9 to a variety of materials and conditions . . . results in considerable savings over drilling and blasting.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U. S. A.

CATERPILLAR

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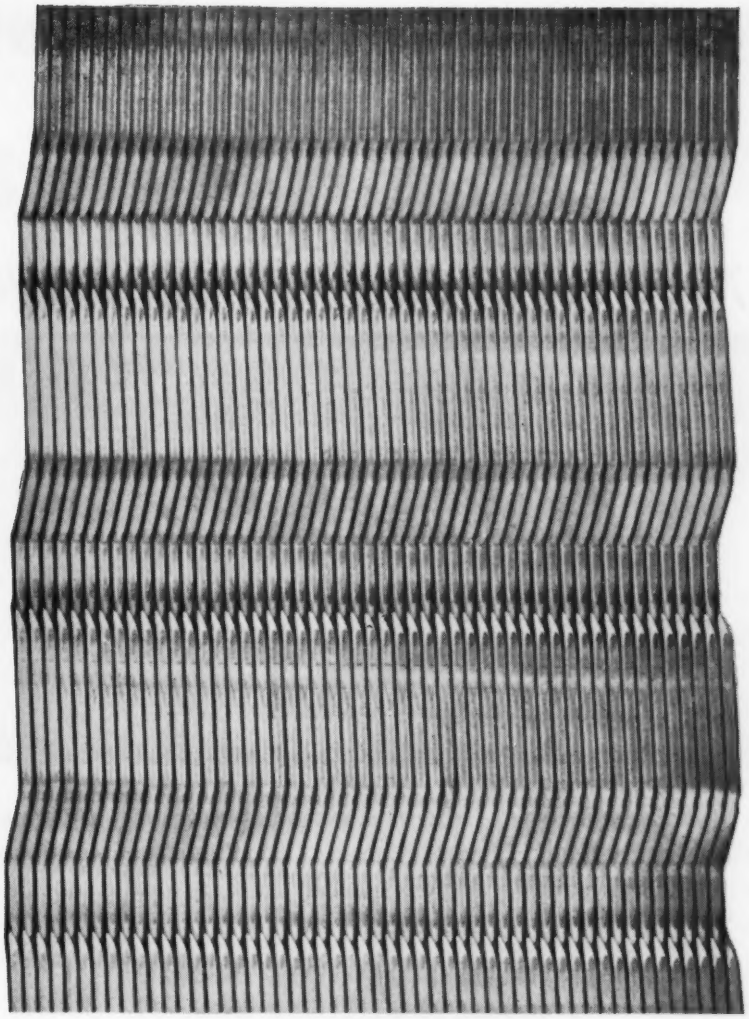


STOP

MEDIA WASTAGE

with Hendrick Cascade Wedge Wire Screen

Whether you're screening coal, iron ore or gravel, you can't beat Hendrick Wedge Wire Cascade screens for dewatering efficiency. Cascade's unique "step" construction eliminates flooding caused by overloads... increases the weight of solids processed as well as the amount of water in screen under flow. Wavy wedge wire breaks up the flow layer and causes a tumbling action that permits far greater throughput. As a result you can sharply increase draining capacity and media recovery. Hendrick Cascade screens can be mounted on any equipment presently using profile type screens. They're available with openings from ¼ to 1½ m.m. in stainless steel. Send in the coupon for more information.

HENDRICK Manufacturing Co.
Carbondale, Penna.

Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens
Hendrick Wedge Wire Screens • Architectural Grilles • Mitco Open Steel
Flooring • Shur-Site Treads • Armorgrids • Hendrick Hydro Dehazers

HENDRICK Manufacturing Company
Carbondale, Penna.

Gentlemen: I want more information on Hendrick Cascade Wedge Wire Screen.

☐ Please have representative call.
☐ Please send me FREE literature on Cascade Wedge Wire Screen.

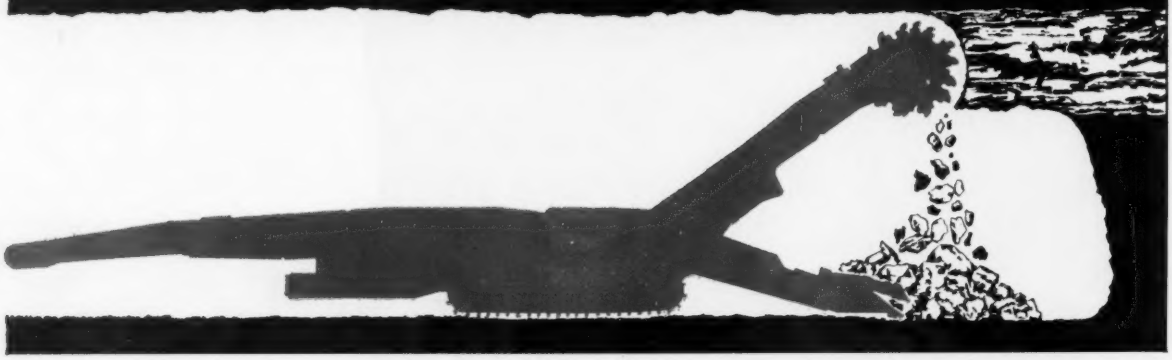
Name_____
Title_____
Company_____
Street_____
City_____ State_____

SELECTIVE MINING ABILITY DELIVERS CLEANER

Lee-Norse CM38

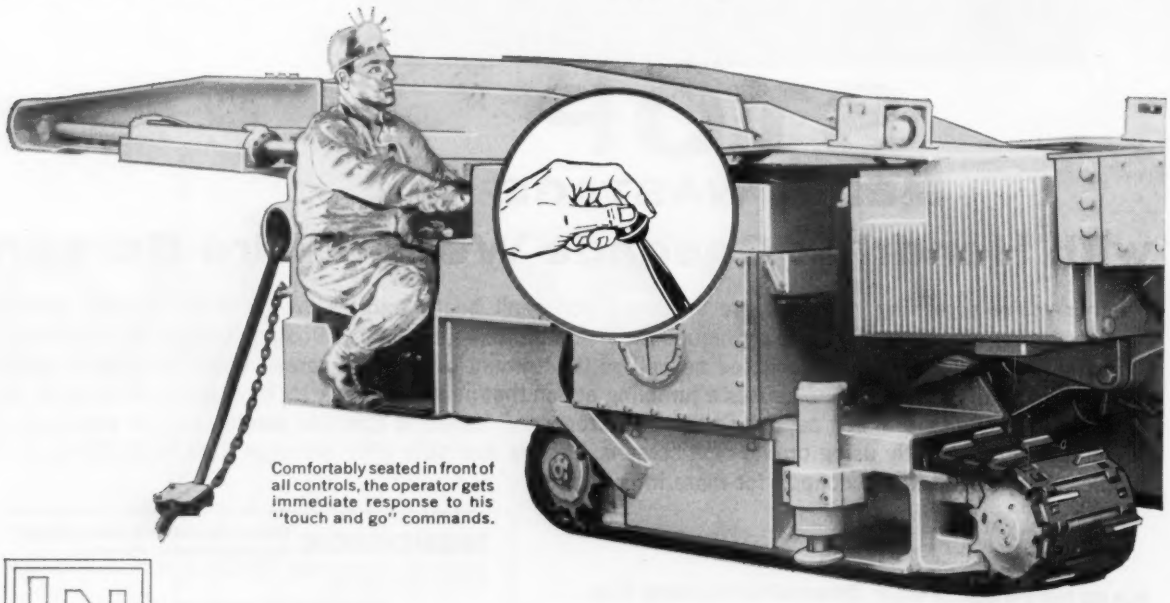
"TOUCH AND GO" VERTICAL ACTION

REMOVES COAL—THEN RETURNS TO CUT THE BONEY ABOVE!



The Selective Mining capacity of the Lee-Norse Miner means a cleaner product delivered to the tipple with a resultant reduction in preparation costs.

Using this method the Miner first mines the coal—then by "touch and go" command the cutters speedily raise upward to cut the rock or boney.



Comfortably seated in front of all controls, the operator gets immediate response to his "touch and go" commands.

Lee-Norse Company CHARLEROI, PENNA.
SPECIALISTS IN COAL MINING EQUIPMENT

Coal High or Low?... Lee-Norse MINERS keep production on the go!

COAL . . . CUTS COSTS

and CM48 MINERS

gives the Lee-Norse Miners these 3 features:

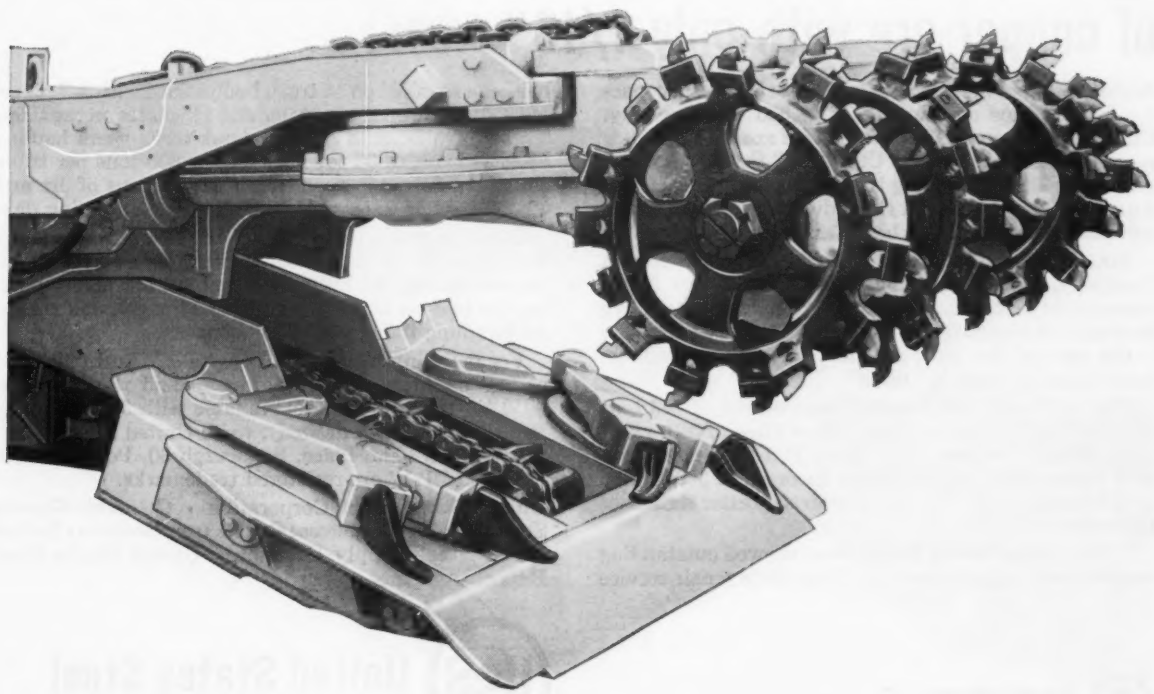
1. SELECTIVE MINING ABILITY

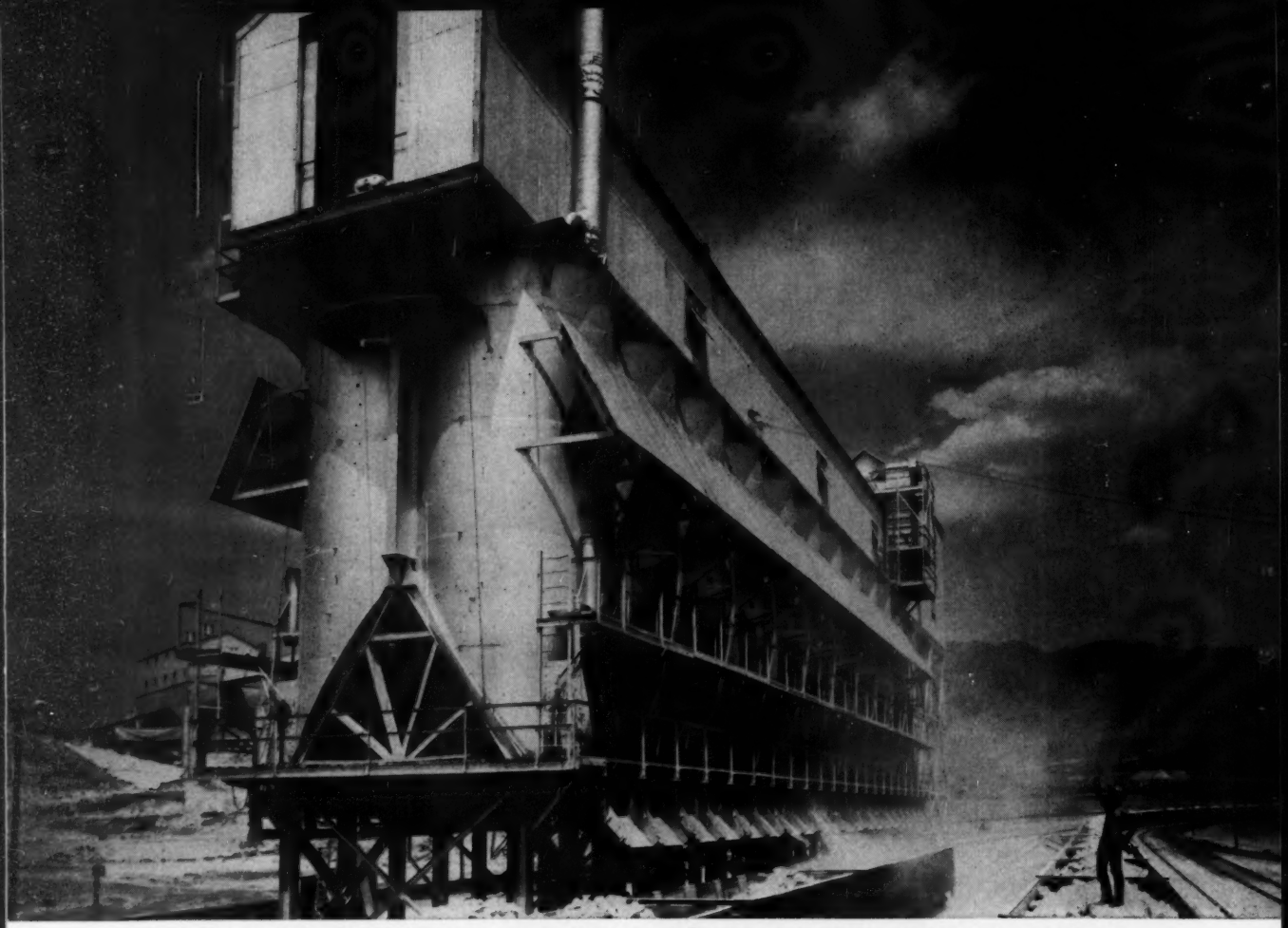
2. TRAMS LOW—CUTS HIGH

3. CONTROLLABLE CUTTING HEIGHTS

"Sweeping" up the unwanted material, the Miner loads it separately into cars for haulage to the disposal area.

"Touch and go" vertical control enables a hundred per cent extraction of high and low coal seams from 42 inches to 120 inches.





Loading bins at Berkeley Pit, The Anaconda Company, Butte, Montana. Copper ore is delivered by a system of conveyor belts from crusher to these 22 bins lined with tough, 321 minimum Brinell USS "T-1" Steel. Railroad cars are loaded in ten to fifteen seconds each.

USS "T-1" Steel bin linings handle 21 million tons of copper ore with only 1/16" wear!

Abrasive copper ore cascades into these 5,000-ton capacity loading bins at the rate of 28,500 tons per day. Chunks of ore up to 12 inches in size are included. For more than 28 months, the USS "T-1" Steel (321 minimum Brinell) plates lining the Berkeley Pit bins of The Anaconda Company, and those diverting the ore to the car-loading chutes, have been taking this punishment.

Mr. Carl Lundborg, Chief Engineer, The Anaconda Company, Butte, Montana, says,"We consider this a remarkable performance record for any such steel. We took spot checks at the point where greatest wear occurs —the gate of the bins. At the time they showed 1/16" *wear on the 3/8" and 3/4" plate!*"

The entire side and bottom liners consist of 163 tons of USS "T-1" Constructional Alloy Steel of 321 minimum Brinell hardness. "T-1" Steel Plates are now available heat-treated to a minimum hardness of 360 Brinell in thicknesses up to 1½ inches for even greater resistance to impact abrasion.

"T-1" Steel truck liners, too, showed outstanding resistance to impact abrasion. Very little repair service has been required on 15 truck bodies lined with 3/4" plates of "T-1" Steel on the bottoms and 3/8" plates on the sides. These have been in service about three years hauling average loads of 36 tons per trip or 800 tons per truck shift. The total pit operation is 28,500 tons of ore and 72,000 tons of waste rock each 24-hour operating day.

Other applications of "T-1" Steel at Anaconda include bulldozer mold boards, skirt plates on the tripper mechanism over the loading bins, and many parts for the two-car tipple where extra strength was needed for handling the larger 75-ton cars.

For more information on USS "T-1" Steel (with 321 or 360 minimum Brinell hardness) and the new USS "T-1" type A Steel (also available with 321 minimum Brinell hardness, if desired), write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania. USS and "T-1" are registered trademarks.

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This mark tells you a product is made of modern, dependable Steel.

USS United States Steel

"JFI Positive Performance Feeder cuts costs six ways at Wyatt-Seanor Mine."

Says John Harvey, Superintendent, Wyatt-Seanor Mine, Simpson Coal and Chemical Corporation.

Simpson Coal and Chemical increased production *and cut costs* when they installed a JFI *positive performance* Feeder in their Wyatt-Seanor Mine in Western Pennsylvania. John Harvey, Wyatt-Seanor Superintendent, reports: "The JFI Feeder allowed us to more fully utilize belt capacity by conveying more coal at slower belt speeds—100 f/p/m *less* than before. Belt wear was noticeably reduced.

"We were also able to eliminate mainline belt spillage from the feeder point to the outside of our mine, and now there is no need to attend belt transfer points. Many man hours are being put to use at more productive jobs. Elimination of surges and overload conditions has reduced mechanical maintenance on belt drives and cut horsepower requirements on those drives."

JFI *Positive Performance* allows high shuttle car discharge rate, complete flexibility of reduction ratio, and profitable multiple belt operation. Feeders are available for both coal and ore mining operations.

If you're after increased production at lower cost, check JFI's complete design and advisory service.

Write today for free literature.

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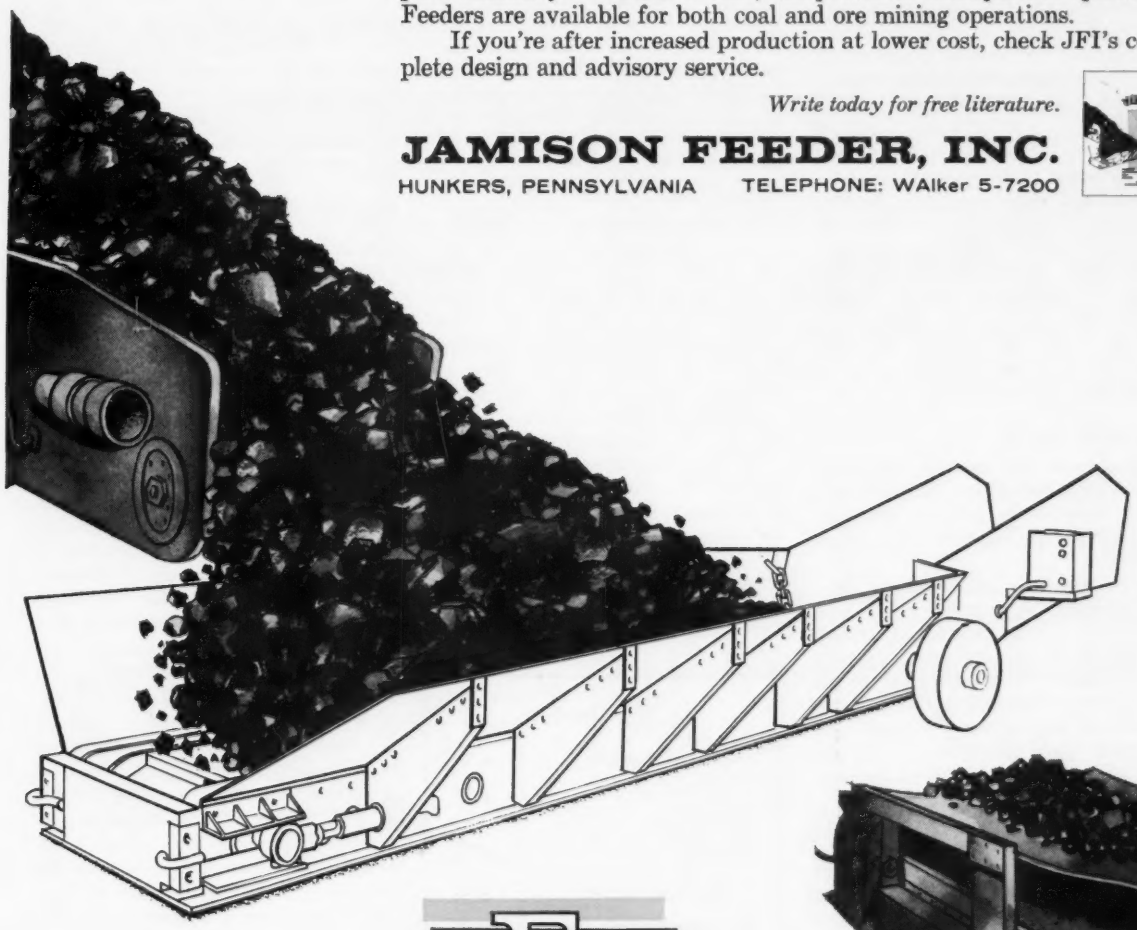

News Roundup

More Hold-Down for Gas Prices?

Further restraint on price rises of natural gas may be one effect of the Kennedy program for the reorganization of federal agencies. Among the agencies specifically discussed by the President was the Federal Power Commission, the regulatory body governing natural gas prices.

He suggested sweeping changes to speed up the handling of rate cases and particularly to assure refunds where applications for such increases were denied. One of the goals in this reorganization, the President announced, is protection of the consumer against an inordinate rise in the price of natural gas. In view of the past history of FPC regulation, and also the activities of Congressional and Administrative departments plus the activities of consumer groups, it is likely that the FPC will be under additional pressure to hold down both wellhead gas prices and pipeline charges.

Complexity of the regulations the FPC is required to enforce has resulted in an enormous backlog of cases. Altogether some 4,000 applications for rate increases by independent natural gas producers and pipelines are pending and still unresolved. Even if no new ones were added, it would take 13 yr to handle the cases now existing.

Suggested Cures

To alleviate this situation, the President urged Congress to enact new legislation reducing the agency's workload. He suggested the commission be authorized to:

- Exempt from application all pipeline construction permits which seek merely to enlarge, extend or replace existing facilities for the benefit of existing customers. This exemption should apply only when such action will not impair the preservation of reserves necessary to supply those consumers or permit indiscriminate invasion of one supplier's territory by another.
- Exempt from rate regulation, all small (under two billion cu ft per year) producers. These small companies must follow the giants in pricing anyway but now account for most of the backlog of cases. The larger producers, however, which number only some 270, affect about 90% of the country's natural gas production.
- Add two members to the commission and clear discretion to allocate or delegate decision-making to smaller panels. The FPC possesses jurisdiction over electric power projects as well, and the chaos and delay now characterizing the gas regulation field may soon increase in the electric power area. Hence, the agency would be expected to shoulder an even greater workload.

Coal is casting a wary eye on the pipeline measure in particular. Accelerated enlargement and extension of existing lines would enable gas utilities to fulfill demands much more quickly, especially during peak periods.

Mileage of natural gas transmission lines has grown from about 260,000 in 1950 to an estimated 629,000 in 1960. And as of the end of February the FPC had pending some 193 applications proposing construction of 5,761 mi of pipeline. This involves a total estimated cost of approximately $850 million.

The How and Why of Natural Gas Growth

Natural gas moved up to second place in the ranks of energy suppliers in 1958 and in 1959 contributed 26.8% to the total consumption, compared to 18.0% in 1950. Coal was then in third place, contributing 23.5% in 1959 against 37.8 in 1950. Oil ranked first. In 1960, gas contributed 28.3% to total consumption while coal contributed 23.1%.

A big reason for gas growth is the fact that it has been grossly underpriced at the well. For example, as of April, 1960, to compare with coal at $5 per ton at the mine, gas should have sold for 19c per MCM at the wellhead. The actual price, however, was 12c per MCM. Average value of natural gas at the well per MCF rose only slightly in the 10-yr period from 1950 to 1960. In 1950 it was 6.6c against an estimated 13.6c in 1960.

The Natural Gas Act, passed in 1938, authorized the FPC to regulate interstate transportation of natural gas but exempted gas production and gathering. For almost two decades this restriction was interpreted by the FPC as meaning it possessed no jurisdiction over natural gas exploration and production activities of independent producers which sold gas to pipeline companies within the state, commonly at or near the wellhead. This interpretation was reversed, however, in the now-famous U. S. Supreme Court decision in the Phillips Petroleum case. The effect of that decision was that while production of natural gas could not be regulated, the sale itself (even at the wellhead), if in interstate commerce and for resale, was subject to regulation. During recent years this decision has inundated the FPC over the immense backlog of producer certificate and rates cases now existing.

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UMW Guilty of Antitrust Violation

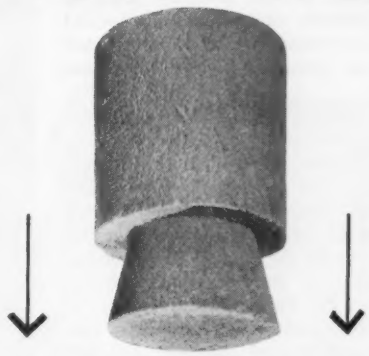
In a precedent-setting case, the United Mine Workers Union was adjudged guilty in U. S. District Court, May 19, of violating federal antitrust laws. A jury found the union and its welfare fund trustees guilty of conspiring with major coal firms to monopolize the soft coal industry and drive small firms out of business. Phillips Brothers Coal Co., a small east Tennessee mine was awarded a $90,000 judgement which, under antitrust laws, is automatically tripled to $270,000. Phillips had sued for $300,000.

In his charge to the jury, presiding Judge Robert L. Taylor said that if a union aids and abets businesses and firms in attempting to restrain trade, the union comes under the jurisdiction of the statutes even though labor unions normally are exempt from antitrust laws. This case stems from a suit filed by the fund trustees against Phillips seeking $56,000 in back welfare fund and royalty payments. Phillips crossfiled charging the royalties were excessive, more than the company's profit and designed to force small mines out of business. A similar case, filed by 16 southeast Tennessee coal firms (*Coal Age*, February, 1961, p 26) seeking $30 million damages, is pending in U. S. District Court in Chattanooga. However, the case was dismissed as it pertains to the fund's trustees.

SEE AUSTIN FOR TIME-SAVING BLASTING PRODUCTS

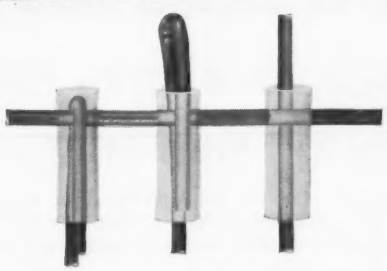
AUSTIN ACP PRIMERS

Six primers, each smaller than a man's fist, designed specially for use with fertilizer grade ammonium nitrates. Very insensitive to shock and abrasion. Three types possess rifle impact sensitivity of zero . . . may be more safely removed from holes that fail to detonate. Central fuse channel, cap well, other handy features.



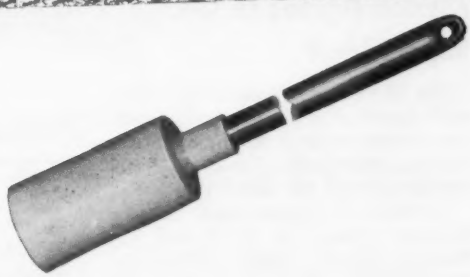
AUSTIN ATP TAMPING PLUGS

Seven cast cement plugs for tamping holes 4″ to 10″ in diameter. Plug is loaded cone first in hole behind the explosive. The base is tamped over the cone and seats itself solidly in the hole—tightly confining the charge. No additional stemming required.



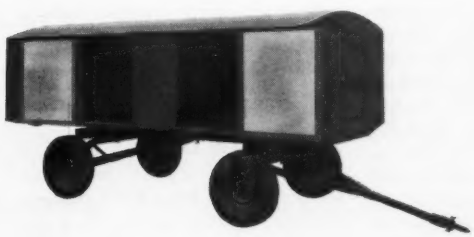
AUSTIN FUSE CONNECTORS

Provide a quick, effective detonating fuse hook-up without tying knots. Simply thread fuse from shot hole through length of connector and press trunk line into grooved slots. Then return branch through end of connector over trunk line and pull tight.



AUSTIN ALUMINUM TAMPING POLES

Strong, lightweight, non-sparking. Weigh only a fraction as much as wood. Won't warp or splinter. Special hook and eye attachments assure quick connection of extra lengths. Models for all size holes.



AUSTIN PORTABLE EXPLOSIVES MAGAZINES

Three types for hauling explosives by light truck or tractor around job sites. Made of welded steel with wood sides and tops. Masonite floors. Easy to load and unload. Designed for rugged service. Approved by state mining authorities.

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- ☐ Aluminum Tamping Poles

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Oil Import Control Program

Assistant Interior Secretary John M. Kelly, recently assigned to supervise and direct the mandatory oil import control program, commented on Department plans.

He told the Western Petroleum Refiners Association in San Antonio, Tex., that following its "searching appraisal" of residual oil imports, the Interior Department "intends to give the crude oil portion of the program equal scrutiny in the weeks ahead." The problems facing oil, coal and other minerals are pressing, Mr. Kelly told the refiners. He referred to coal as an "under-developed, under-used natural resource" and said such under-development "is as abhorrent to true conversion as wasteful use." "We have a coal industry which cannot be allowed to decline if it is expected to meet the greatly increased demands which would be placed upon it in time of national emergency." The Department will work to alleviate this "disturbing situation," he promised.

Mexico Agrees to Oil Import Limit

The Mexican government has voluntarily agreed to limit "overland" petroleum imports entering the United States through Brownsville, Tex., to 30,000 barrels a day for the next 3 yr.

In making the announcement, Interior Secretary Stewart L. Udall said the Mexican import situation which was threatening the entire oil import control program, "has now been stabilized."

Permex, Mexico's nationalized oil industry, said it will limit the exempt oil movement through Brownsville to 10,000 barrels a day of residual fuel oil, with the remainder to be heavy crude oil. Permex further stated that it will consult with the U. S. Government before taking any steps that might result in increasing the exempt imports.

Coal Co. Grants $9,000 to Forestry Students at SIU

Sahara Coal Co., Chicago, Ill., has extended a $9,000 grant to Southern Illinois University for forestry scholarships over the next 4 yr. Under the provisions of the grant, 10 cash scholarship grants of $225 each will be made annually to SIU forestry students meeting certain scholastic and residence requirements. Preference in awarding scholarships must be given first to students from Saline County where the firm has coal mines and then to those from southern Illinois.

SOUTHERN APPALACHIAN COAL MINES were visited recently on a week's inspection trip made by ten mining engineering students from Ohio State University and Professor J. R. Lucas (standing, left) and Professor Robert Frantz (standing, right). The group is pictured deep underground in the High Splint Seam of U. S. Steel's Mine No. 32 in Lynch, Ky., where a very high-quality coal is produced. Similar visits were made to Alabama By-Products Co. SEGCO No. 1 Mine; U. S. Steel's TCI Div. Winona No. 13 Mine; American Zinc Co.'s Young Mine; and Clinchfield Coal Corp.'s Moss No. 3 Mine. The group noted with interest the tremendous resurgence and potential of the coal industry in Birmingham, Ala., which has resulted from rapid growth of the coal-fueled electric utility industry in the South. Also of special interest to the visitors was Clinchfield's Moss No. 3 Mine where the 15-ft coal seam presents a challenge for the solution of unusual mining problems and potential for record production from specially-designed conventional units.

Preparation Facilities

Eastern Gas & Fuel Associates, Federal No. 1 Mine, Grant Town, W. Va.—Contract closed with Deister Concentrator Co., Inc., for 12 Concenco "77" twin-deck, Diagonal-Deck coal washing tables to handle ¼-inx48M fraction coal. The contract also includes 12 Concenco splitters for feed distribution and two Concenco Model CCF 6-way feed distributors.

Allied Chemical Corp., Semet Solvay Div., Harewood Colliery, Longacre, Fayette County, W. Va.—Contract closed with Industrial Engineering & Construction Co. and Eimco Corp. for an 8 ft 10 inx6 Agidisc filter to handle 10 tph froth flotation concentrate; a 90-ft-dia thickener with motorized lifting device to handle 5 tph froth cell tailings in 1,500 gpm of water; and an 11½x24-ft face drum filter with a roll discharge to handle thickener underflow. The plant will also be equipped with Wemco flotation cells, Deister tables and Allis-Chalmers vibrating screen. Washery slurry containing minus 28M will be treated.

Mountaineer Coal Co., Williams Mine, Stringer, W. Va.—Contract closed with Industrial Engineering & Construction Co., Inc. for Reineveld dryer installation to handle ⅜x0 coal at 100 tph. Allis-Chalmers vibrating screens will also be used.

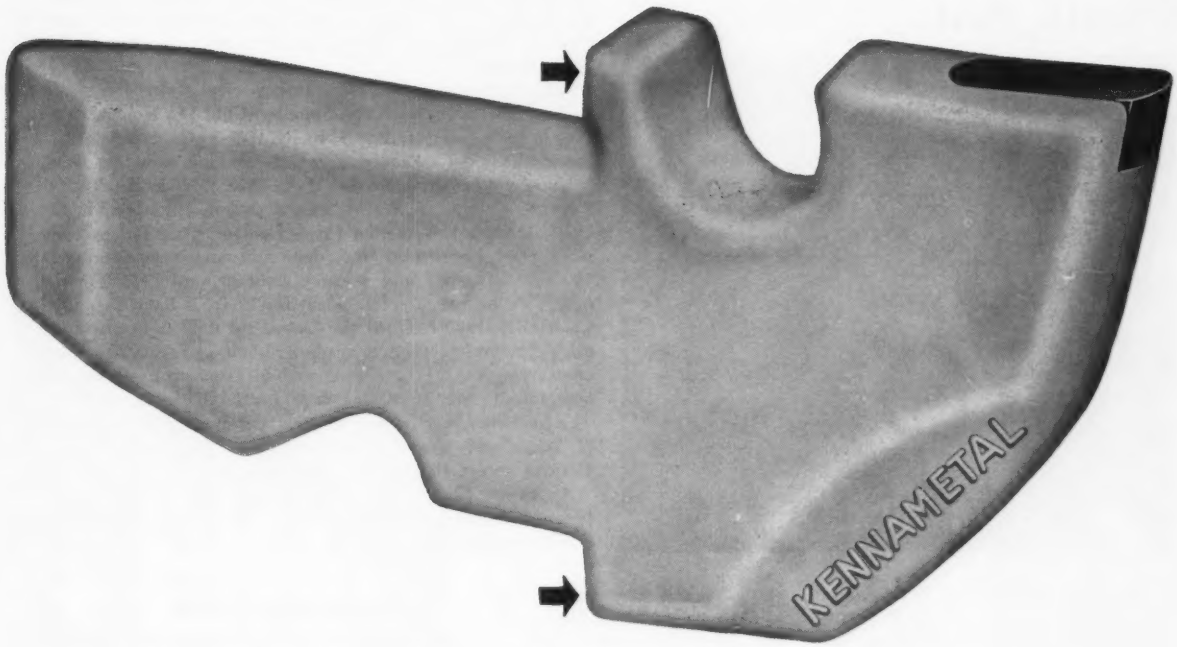
Westmoreland Coal Co., Hampton No. 3 Mine, Hampton Mines, W. Va.—Contract closed with Industrial Engineering & Construction Co., Inc. for a vacuum filter installation to handle minus 28M refuse at 33 tph. Major equipment includes an Eimco filter.

U. S. Steel Corp., Mine No. 9, Filbert, W. Va.—Contract closed with Nolan Co. for five 40 hp Porta-Feeders for moving mine cars at loading points.

Jewell Ridge Coal Co., Tilford, Ky.—Purchase authority issued to Daniels Co. for components for a DMS dense-media precision coal washer.

Page Coal & Coke Co., Buckeye No. 3 Mine, Stephenson, W. Va.—Purchase authority issued to Daniels Co. covering a complete DMS dense-media precision coal-washing facility, including dense-media washing equipment and accessories and appurtenances to prepare plus ⅛-in coal.

new...KENNAMETAL U21 BIT



dual gage shoulder design
. . . plus new achievement in dimensional control

Rigid dimensional control is the most important feature of the new Kennametal U21 Cutter Bit. Here's why:

• **CLOSER TOLERANCES** assure a tighter fit and provide greater stability of the bit in the block. This, in turn, means less "pounding" or deformation of the tool holder, and less flexing of the rubber keeper with resultant longer life. Firm positioning against the work provides more positive cutting action.

• **DUAL GAGE SHOULDERS** provide front and rear bearing areas to absorb the shock forces encountered in severe cutting conditions.

• **PULL-OUT NOTCH,** replacing the pull-out shoulder, is located to permit easier, safer extraction of tools from blocks on ripper-type chains. Bits are removed quickly . . . which saves you time and money.

Now's the time to prove, in your mine, how the new dual shoulder, quick-change Kennametal U21 will stand up under the most rugged cutting conditions. Let the Kennametal difference in quality and design show up in performance—more production—greater profits. Call your Kennametal representative or contact us direct. KENNAMETAL INC., Mining Tool Division, Bedford, Pennsylvania. Phone 623-5134.

The new U21 Cutter Bit is available in three standard tip styles. Ordering designations are U21RA, U21R, and U21. 34225

U21
Full Nose Radius Style

U21R
Recessed or Channel Style

U21RA
Cylindrical Plug Style

KENNAMETAL
...Partners in Progress

People in Coal

WVU Fills Dean and Director Posts

CHARLES T. HOLLAND has been named dean of the School of Mines at West Virginia University and director of Mining & Industrial Extension. He is head of the Department of Mining Engineering at Virginia Polytechnic Institute and a West Virginia alumnus who served for 9 yr as a member of the WVU faculty.

His appointment fills the vacancy created by the death on Feb. 20 of Dean G. Ralph Spindler. Until Mr. Holland takes over his new posts on Aug. 1, Richard W. Laird, associate professor of mining engineering, will be serving as acting dean.

Upon graduation from WVU in 1928, Mr. Holland spent 2 yr at Thurmond, W. Va., as a mining engineer for the H. E. Willson Engineering Co. before returning for graduate work which brought an M. S. degree in mining engineering in 1932. He remained as a research assistant until 1934. For the next 5 yr, he was superintendent for Lookout Smokeless Coal Co. and in 1939 rejoined the University staff as instructor in mining extension. He was made assistant professor of mining engineering in 1942 and promoted to associate professor and assistant director of Mining & Industrial Extension in 1945. The following year he was made acting director of the School of Mines and promoted to professor, a position he left in 1948 to accept the Virginia Tech appointment.

An author of 60 technical publications, Mr. Holland served in many consulting assignments here and abroad pertaining to roof and pillar action in coal mines.

David R. Mitchell has been named dean of the College of Mineral Industries at Pennsylvania State University. Appointed associate dean June 30, 1960, he was designated acting dean last November following resignation of **Dr. O. F. Tuttle** as dean. Mr. Mitchell will continue to serve also as chairman of the Division of Mineral Engineering and professor of mining engineering. He is author of the book entitled "Coal Preparation" and more than a hundred technical papers on mining and mineral preparation subjects.

Don Gasper, formerly business analyst, has been appointed manager, business surveys, Consolidation Coal Co. He also has been named a member of the National Coal Association Economics Committee. A member of Consol's business surveys staff since 1951, he has been doing graduate work at the University of Pittsburgh since 1956. He graduated from Penn State University with a B. S. degree in 1950 followed by a master's degree one year later.

Old Ben Coal Corp. has promoted five. **R. B. Starek**, vice president, sales, has been elected senior vice president; **D. P. Buchanan**, manager, industrial sales, has been named vice president, industrial sales; **W. C. Campbell**, assistant to the president, has been appointed vice president, planning and development; **R. E. Exum**, by-product coals, has been elected vice president, industrial sales and **Eugene T. Moroni**, assistant to vice president, operations, has been appointed manager of mines.

W. A. Gallagher has been elected executive vice president of Westmoreland Coal Co. and Stonega Coke & Coal Co. He had been vice president of these companies.

M&O Coal Co. has elected **Donald Dean Saxton**, president, and **E. F. Clevenger**, secretary and treasurer. In addition, **L. B. "Brownie" Coleman** was made manager, Distribution & Traffic Dept., and will move to the Cleveland Office. And **R. O. "Mike" Delaney** was appointed vice president, Eastern Sales, with new headquarters at the Wynnewood, Pa., office.

Robert E. Kamm has been promoted to president, Peerless Eagle Coal Co., while **William S. Bryant** has been named vice president and treasurer. Both men had been employed by Peerless' predecessor company, Peters Creek Coal Co. Mr. Kamm started as a timberman in 1949 and advanced to section foreman, assistant mine foreman, superintendent, vice president.

Olga Coal Co., Coalwood, W. Va., has announced personnel changes. **Jack Burnett** who has retired as mine foreman, Olga No. 1 Mine has been succeeded by **Woodrow L. Marshall**, formerly assistant mine foreman, and **Albert Johnson Sr.**, section foreman, replaces Mr. Marshall. At Olga No. 2 Mine, **A. Raymond Crewey**, section foreman, fills assistant mine foreman post, a vacancy created by death of **Clyde Pruett.**

Associations

The Central Pennsylvania Safety Association has elected **Dennis J. Kennan** of Spangler, Pa., to his 13th consecutive term as president. Also reelected were **C. H. Maize**, vice president; **E. H. Pauley**, secretary; and **J. C. Leonard**, treasurer.

W. G. Jones of Phillipsburg, Pa., has been appointed director of conservation for the **Central Pennsylvania Open Pit Mining Association.** He will assist with land reclamation problems and act as liaison between coal operators and various state agencies concerned with strip mining.

Obituary

Alex U. Miller of Tucson, Ariz., died April 10 in Buena Park, Calif. He was 81 yr old. From 1941 until his retirement in February, 1950, he had served as the first supervisor of District C, U. S. Bureau of Mines at Mount Hope, W. Va., with the exception of several months service with the Solid Fuels Administration in Washington D. C., during World War II. For 3 yr after his retirement, he was chairman of the Coal Mine Safety Board Review. Prior to his supervisor's post, Mr. Miller served the Bureau of Mines as a first-aid and mine rescue instructor, and assisted in recovery work at mine fires and explosions.

Galis is growing up!

. . . to completely fill the needs of the Mining Industry

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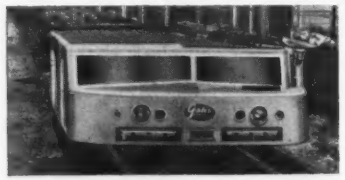

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Greatest vehicle of its kind—for SAFETY—on the market today. Never so many safety features from brakes—ruggedness of frame—to all the safety paraphernalia on your easiest handling automobile. A brilliant companion to our utility HAULMASTER.

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Three (3) models to meet conditions in all mines—all rotary—percussion—2 in 1—flick of a valve converts one to the other. (Model #310, narrow and low keeps operator always under bolts.) All 4-wheel maneuverability for fast, fast positioning.

FACEMASTER Face Drills

"Brothers under the paint," to Galis Roof Drills. Most working parts interchangeable. All controls handy for one man operation. Get specifications on latest permissible model—engineered for greatest speed and economy.

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Another new item in the Galis line. High capacity; non-stop operation; low maintenance sizing, dewatering and conveying. There's a type and size tailored to every operation, delivering greatest economy and speed.

GALIS ACQUIRES FAIRMONT MACHINERY AND LECCO SCREENS

Now Galis affiliates offer services ranging from complete preparation plants through to the rewinding of a motor. "One stop shopping" gives the advantages of speedy combined engineering services, greatly reduced selling costs, co-ordinated shop fabrication proccedure. What would you like in a hurry? Turn-key coal preparation plant—overhaul your present plant with newest type conveyor equipment—30 H.P. D.C. permissible Galis motors—Chance sand flotation coal washing and Lecco screens to upgrade product. Expert steel fabricating, chutes, hoppers, trusses.

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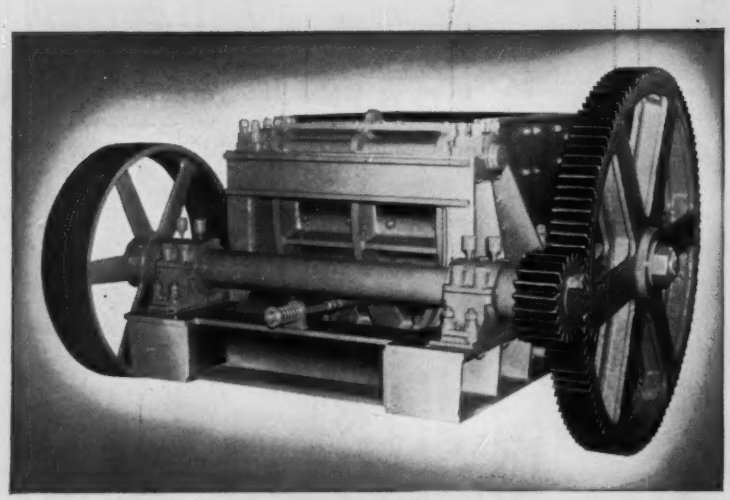

CRUSHING MINE REFUSE?
Pennsylvania HERCULES can lower costs for crushing hard rock, slate, other refuse

Pennsylvania has researched the factors that make single roll crushing costs mount—and offers a machine specifically designed, and *job-proved*, to keep costs down.

Cast alloy steel roll shell is made in one piece and keyed as well as shrunk on the rollshaft. No segments or renewable teeth to loosen or fall out. Readily accessible teeth are easily built up by welding.

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• Hopper jams are prevented by the larger hopper opening and spacious throat opening made possible by the contour of the breaker plate.

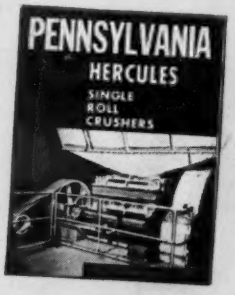
New automatic toggle release supplies positive release mechanism for breaker plate.

New design of countershaft placement, plus large diameter of the gear improve stress distribution on countershaft bearings.

Hercules bearings are away from the frame. Easy to get at, easy to maintain.

Breaker plate is heavy steel fabrication lined with cast manganese steel wearing plates; guaranteed against cracks and flaws.

If you have a job where a single roll might be used, find out more how this Pennsylvania Hercules will save you money in more ways than one. Send for new Bulletin 2020.



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Coal Abroad

British Steel Firm Wants U.S. Coal

The old adage about "carrying coals to Newcastle" may soon be changed to "carrying coals to South Wales." Though South Wales has one of the richest coal fields in Britain, one of its largest steel companies—Steel Co. of Wales—has asked the Board of Trade for permission to import coal from the United States. Reason? The company claims that even with the cost of transport added, it can save as much as $2.80 per ton on American coal over British supplies.

Other steel companies are watching what sort of reception the application gets. Britain's steel industry has long complained that some Continental steel makers—particularly Italian and German—have gained a competitive advantage through use of American coal. The urge to buy American was strengthened by a British coal price increase last September which added an average of around 84c a ton to the price paid by the steel firms.

An official of the Iron & Steel Institute said that while coking coal was plentiful, its cost at the pithead had risen nearly six-fold since World War II while the cost in the U. S. had hardly doubled.

It is considered probable that approval of the steel company's application would set off strikes and, partly because of that, the decision is expected to be made at Cabinet level.

Overseas Flashes

JAPAN—A mission sent to Europe to investigate energy policies has returned to Tokyo with a strong recommendation that Japan continue her policy of protecting the domestic coal industry from competition of petroleum imports. A member of the mission said the Japanese found energy policies in Western Europe in complete confusion. In fact, he said, Europeans advised Japan to continue her coal protection policies. There has been considerable agitation among Japanese fuel users to abandon the rehabilitation program in the coal industry which includes heavy protection against fuel oil imports. Result of the mission's recommendations may be the further postponement of Japanese plans for freeing all petroleum imports.

YUGOSLAVIA—Coal production here is rising rapidly with present production well above 23 million tons annually. In addition, production of semi-coked lignite and metallurgical coke is increasing. With reserves estimated at over 21 billion tons and the introduction of mechanization, it is expected production will reach 33 million tons by 1965. Despite a rapid growth of large hydroelectric power plants and petroleum gas fuel stations, coal is expected to furnish the country's largest power requirements.

SOUTHERN RHODESIA — Expansion this year is likely to lead to a new record in Southern Rhodesia's mineral output exceeding last year's $72,800,000 record production. Exploration of the vast, untouched Bubye coal field near Beit Bridge is well advanced and the Colony's Minerals Information Bureau is now trying to interest Japan, which imports nearly four million tons of American coking coal a year, in buying Rhodesian coal instead.

GREAT BRITAIN—Chancellor of the Exchequer Selwyn Lloyd reimposed a 2c-per-gal tax on British fuel oils, gas oil and kerosene, which have been duty-free since 1947. In addition, the present 1c-per-gal tax on some minor categories of heavy oil, chiefly lubricants, has been tripled. The surprise announcement was sharply criticized by oil interests but enthusiastically welcomed by the coal industry. The tax should swing the price relationship in coal's favor by nearly $2.80 or 15%. Although the tax was presented by the government strictly as a revenue-raiser, there has been widespread assumption it was also a gesture to the hard-pressed coal industry.

New Books

Coal And Steel in Europe

Europe's Coal And Steel Community, by Louis Lister. A study of how the European Coal and Steel Community has worked out in actual practice. Findings show that in certain areas the Community has accomplished little of what was originally hoped. In others it has gone far beyond what was expected and there have been some unexpected results. The authors note that the movement toward economic union in Europe is quickening. *495 pp. 6x9½-in; cloth. $8, The Twentieth Century Fund, 41 E. 70 St., New York 21, N. Y.*

Chemistry-Physics Handbook

Handbook of Chemistry and Physics, updated for the 42nd time, is a one-source reference in physics, chemistry and mathematics in one volume. Over 200 recognized authorities in their own research fields have contributed to this new edition. Among the new tables are: diffusion of metals into metals; interplanetary orbits and standard types of stainless steel. Among the revised data

(*Continued on p. 40*)

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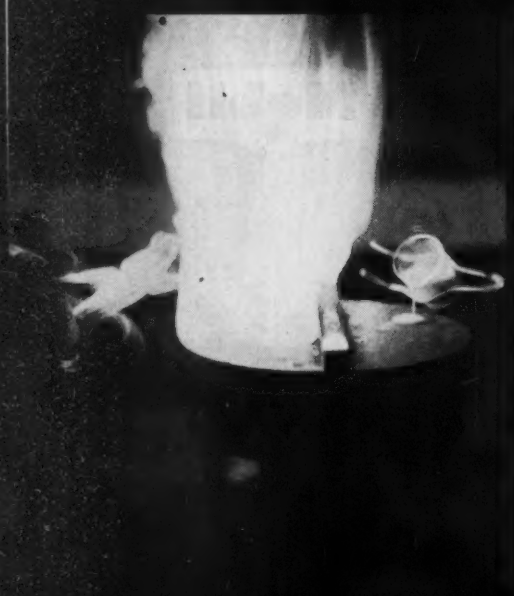
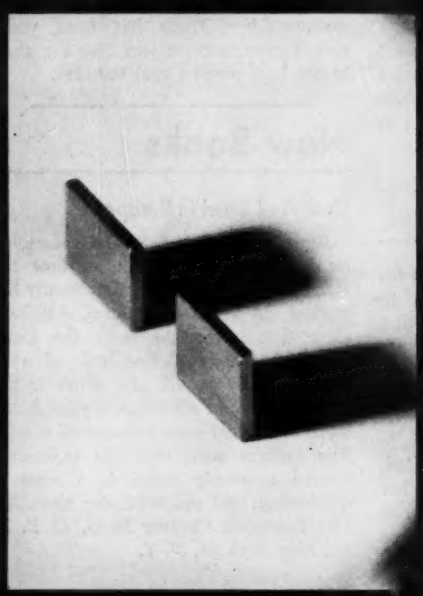
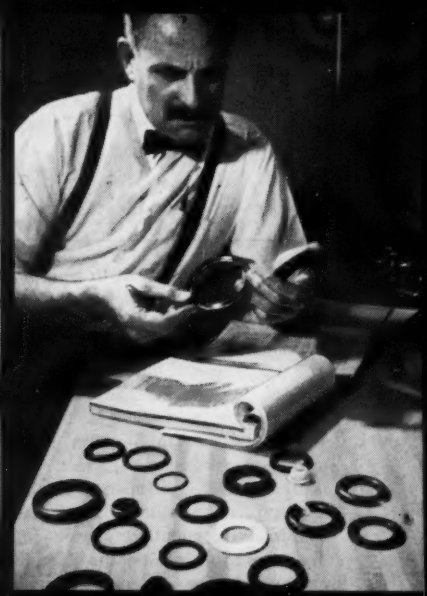


Ignition resistance approved by USBM—PYROGARD helps you protect your property and personnel against fire. It passes comprehensive fire-resistance standards of US Bureau of Mines (USBM approval No. 30-3). Ignition resistance is demonstrated here. Hydraulic oil (left) bursts into flame immediately and PYROGARD (right) resists combustion when poured onto steel plate heated to 1000F.



Good anti-wear properties assure long pump life—PYROGARD fire-resistant fluids are designed for pumps and pressures commonly encountered in mining machinery . . . give excellent protection against pump wear for fluids of this type, even at elevated temperatures. Pump vane at left is new. Vane at right has 1000 hours of service with PYROGARD at 160F and 1000 PSI. Wear is almost undetectable.



Compatibility with seals, metals eases fluid installation—PYROGARD fire-resistant fluids are easily installed because they have no adverse effect on most packings, seals, or hoses, and are non-corrosive to metals normally found in mine hydraulic systems. Containing effective rust inhibitors, PYROGARD fire-resistant fluids give excellent protection against rusting wherever they contact metal.

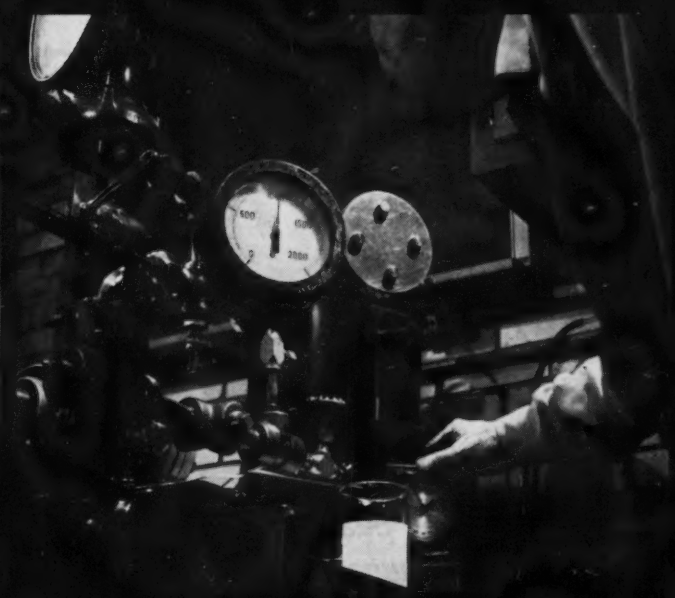
POSITIVE HYDRAULIC RESPONSE...

Now, the makers of world-famous Mobil petroleum hydraulic oils bring you PYROGARD D and PYROGARD R—two new fire-resistant fluids that offer positive hydraulic response *plus* improved mine safety... at low cost.

Mobil PYROGARD fire-resistant fluids are water-in-oil emulsions containing special chemical addition agents. They've been thoroughly field tested in actual mine service, and are giving excellent performance under severe conditions in cutters, loaders, shuttle cars, drilling machines and continuous miners.

The major benefits provided by PYROGARD fire-resistant fluids are detailed below. In addition you receive the help of experienced Mobil Engineers in applying them to your equipment. Their specialized know-how in the installation and maintenance of fire-resistant fluids will make the procedure sure and simple. Examine the benefits of PYROGARD fire-resistant fluids—then contact your nearest Mobil Representative.

Long-term stability in storage and use assures uninterrupted production — PYROGARD fire-resistant fluids are highly stable even at higher-than-normal temperatures—resist breakdown, foaming and water separation—keep pump parts and screens free of deposits. And with PYROGARD, water evaporation is retarded by a thin oil skin that forms when the emulsion is at rest, yet readily remixes when fluid is agitated (shown above).



Unusual flow properties assure positive hydraulic response, yet reduce leakage —PYROGARD fire-resistant fluids have unusual viscosity characteristics . . . resist leakage at static joints, yet give rapid flow and response elsewhere in the system. In apparatus above, a specially designed "leak chamber," introduced into hydraulic system, shows that PYROGARD leaks less than ordinary hydraulic oil.

MOBIL OIL COMPANY, 150 East 42nd Street, New York 17, N. Y.

Current Coal Patents

Oliver S. North
Patent Research and Abstracting
Washington, D. C.

Mechanical miner having offset rotary heads, E. L. Anderson (assigned to Goodman Mfg. Co., Chicago, Ill.), Apr. 11, 1961. In an improved mining machine, a series of coaxial rotary cutters are arranged to swing about an offset pivotal axis in such a manner that the cutters traverse the whole area of a floor or roof surface, thereby eliminating the necessity for auxiliary reciprocating or core breaking devices to sweep the floor or roof surfaces level. The bits travel in a path oblique to the head in order to cut and dislodge material between pairs of adjacent bits. No. 2,979,319.

Coal cutting, drilling, and loading machine, R. H. Goodrich (assigned to Joy Mfg. Co., Pittsburgh, Pa.), Apr. 18, 1961. Design for an improved kerf cutting machine of the universally adjustable cutterbar type having conveying means associated therewith to provide a self-contained cutting and loading unit wherein the cutter bar is operable not only to cut the coal but also to serve as a gathering bar for loading loose coal onto the conveyor. No. 2,980,409.

Mining machine having cutting and breaking rolls and suction transporting means, A. Kircher and H. Siegelmann (assigned to Gelsenkirchener, Bergwerks A.G., Essen, Germany), Apr. 25, 1961. Design for a mining machine that will not only cut and dislodge the coal from the seam but will also crush it to such a size that it can be easily transported within a narrow space. The transporting means is in the form of a suction conduit. Development of dangerous quantities of coal dust is prevented, thereby eliminating need for wetting the coal. No. 2,981,527.

Method for preparing coke oven feed from coal-char blends, R. J. Friedrich (assigned to Consolidation Coal Co., Pittsburgh, Pa.), Apr. 11, 1961. In a method for blending coking coal and fluidizer char to form a feed for metallurgical coke ovens, each ton of coking coal is first blended with up to one gallon of a hydrocarbon oil containing at least one pint of aliphatic constituents, and the resulting oil-treated coal is mixed with minus 20-mesh fluidizer char. A desirable high-bulk-density blend is produced. No. 2,979,441.

Tiltable deep mining auger machine, G. L. Adams (assigned to The Salem Tool Co., Salem, Ohio), Apr. 11, 1961. Improved design for a deep mining auger machine that can be tilted and swiveled along inclined angles. This machine is especially suitable for use in anthracite seams. No. 2,979,320.

Driven steerable wheel assemblies for mine haulage vehicles and braking mechanisms therefor, A. L. Lee and A. B. Coval (assigned to Consolidation Coal Co., Pittsburgh, Pa.), May 2, 1961. Design for a liquid-cooled braking mechanism for the power driven and steerable wheel assemblies mounted on the frames of 4-wheel driven mine haulage vehicles. The braking force may be applied to either pair of wheels. No. 2,982,370.

Moisture separation from granular materials, F. J. Fontein (assigned to Stamicarbon N.V., Heerlen, Netherlands, May 2, 1961. Method and apparatus for partially or completely removing moisture from fine coal. A continuously moving layer of the coal is formed and supported in such a manner that the moisture concentrates in the lower part of the layer. The layer is then split into a substantially moisture-free fraction and a still-wet fraction. No. 2,982,411.

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Put CF&I vibrating screens to any kind of test and they'll pass with flying colors. That's because CF&I Space Screens are made from special oil-tempered, alloy and stainless steel wire . . . precision woven to stay tight and uniform for a long time.

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Bituminous Output

YEAR TO DATE	PRODUCTION
May 13, 1961	134,367,000
May 14, 1960	162,286,000

1961 output 17.2% behind 1960.

WEEK ENDING	PRODUCTION
May 13, 1961	7,425,000
May 14, 1960	8,380,000

Anthracite Output

YEAR TO DATE	PRODUCTION
May 13, 1961	6,873,000
May 14, 1960	6,698,000

1961 output 2.6% ahead of 1960.

WEEK ENDING	PRODUCTION
May 13, 1961	328,000
May 14, 1960	296,000

Better products, *faster*, from your Bearing Specialist:

For smoother "coaling," choose smoother rolling Bower Bearings

Downtime means lost production—and you can't make it up! That's why it's so important to choose only the very best components for your mining equipment.

Take roller bearings, for example. You look for dependability, minimum wear, and longer service life. And that spells Bower. Bower Roller Bearings (straight and tapered) are designed to meet the grueling demands of the mine—and then some! In everything from conveyor idlers and continuous miners to shovels and shuttle cars, Bower Roller Bearings stand up longer, hold maintenance to a minimum.

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Nationals keep lubricant in, dirt out of bearings in your expensive machines. You have a big investment in your machines and the longer they stay on the job *without repairs*, the faster your profits roll in. National seals keep grit, water, and corrosion—the bane of bearing life—under positive control regardless of conditions.

National Oil Seals in Micro-Torc® leather or Syntech rubber come in standard or made-to-order sizes. *National Micro-Torc leather* is impregnated only part-way through. The coated side seals perfectly; the untreated porous side absorbs the lubricant that leather needs to stay flexible, run cooler and longer. *National Syntech synthetics* are prescription-blended to meet the most exacting conditions of temperatures, shaft speeds, and other critical factors.

Never reuse old seals. Call your National Seal distributor for the new and better replacement.

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Specify Anaconda all Butyl Shovel Cable

This new shovel cable—the toughest in the industry—cuts shovel downtime. Months of torture testing throughout the country have proved it.

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It was twisted, kinked, soaked, crushed and run over.

Its new Butyl *jacket* is the reason for this extra durability in the face of the effects of ozone and moisture and extreme physical punishment.

It is especially compounded to combine flexibility at low temperatures with thermal stability at high temperatures.

Here are other construction features which contribute to this cable's unequalled service record:

1. Anaconda's rubber-core grounding conductors offer a cushioning effect which minimizes pinching and wire breaking and offers greater ground contact protection.
2. Special shielding—a combination of copper cross-braided with cotton—eliminates chafing (and makes splicing faster and easier too).
3. Insulation is a special high-grade Butyl that withstands ozone, heat, and moisture.

Check all the features of this job-proved new shovel cable—they add up to extra cable life, less downtime, and dollar savings. Contact Department EFL-1-CA, Anaconda Wire and Cable Company, 25 Broadway, New York 4, N. Y.

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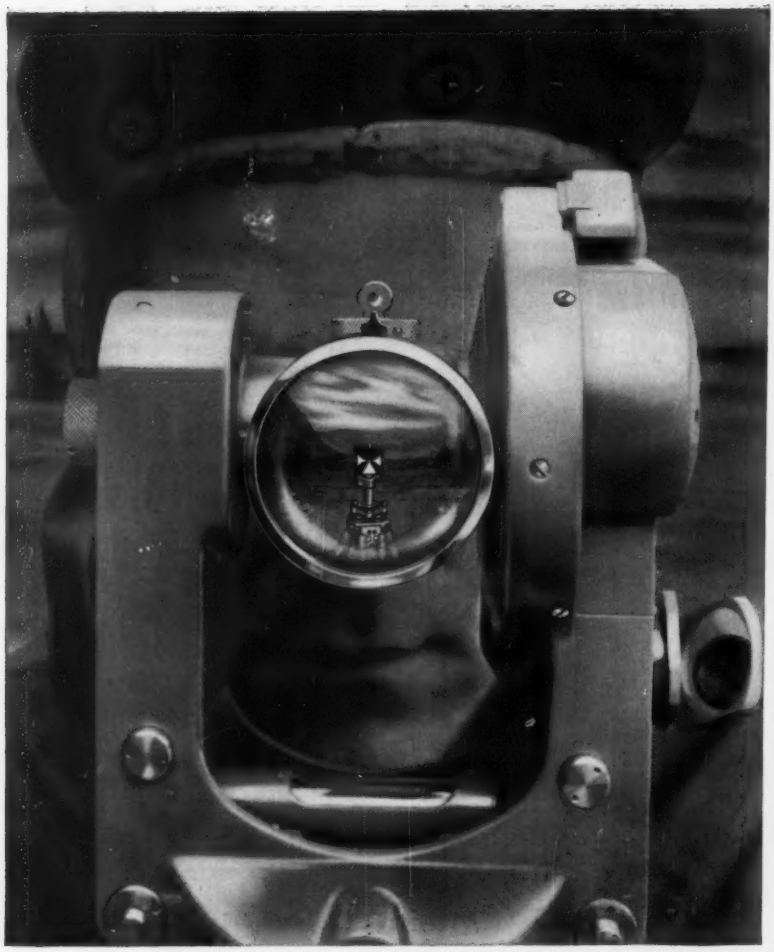

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are atomic weights, trade names of plastics and nuclear spins. *3400 pp. $12, The Chemical Rubber Co., 2310 Superior Ave., Cleveland 14, Ohio.*

Processing

Aufbereitungs-Technik is a new periodical (written in German, with English and French summaries) dealing with the problems of processing solid raw materials. Typical articles discuss sintering of flue dust, bulk material storage, and hydrocone crushers in the rock and gravel industry. *Yearly subscription, 48 DM in Germany, 60 DM abroad. Aufbereitungs-Technik, Kleine Wilhelmstrasse 7, Wiesbaden, West Germany.*

Aufbereitung der Steinkohle, Part 1 (in German) describes the various processes for cleaning coal. It also contains an excellent series of illustrations of the washing units. *407 pp. 8½x12-in; cloth. 96 DM, Verlag Gluckauf, G.m.b.H., Huyssenallee 105, Essen, Germany.*

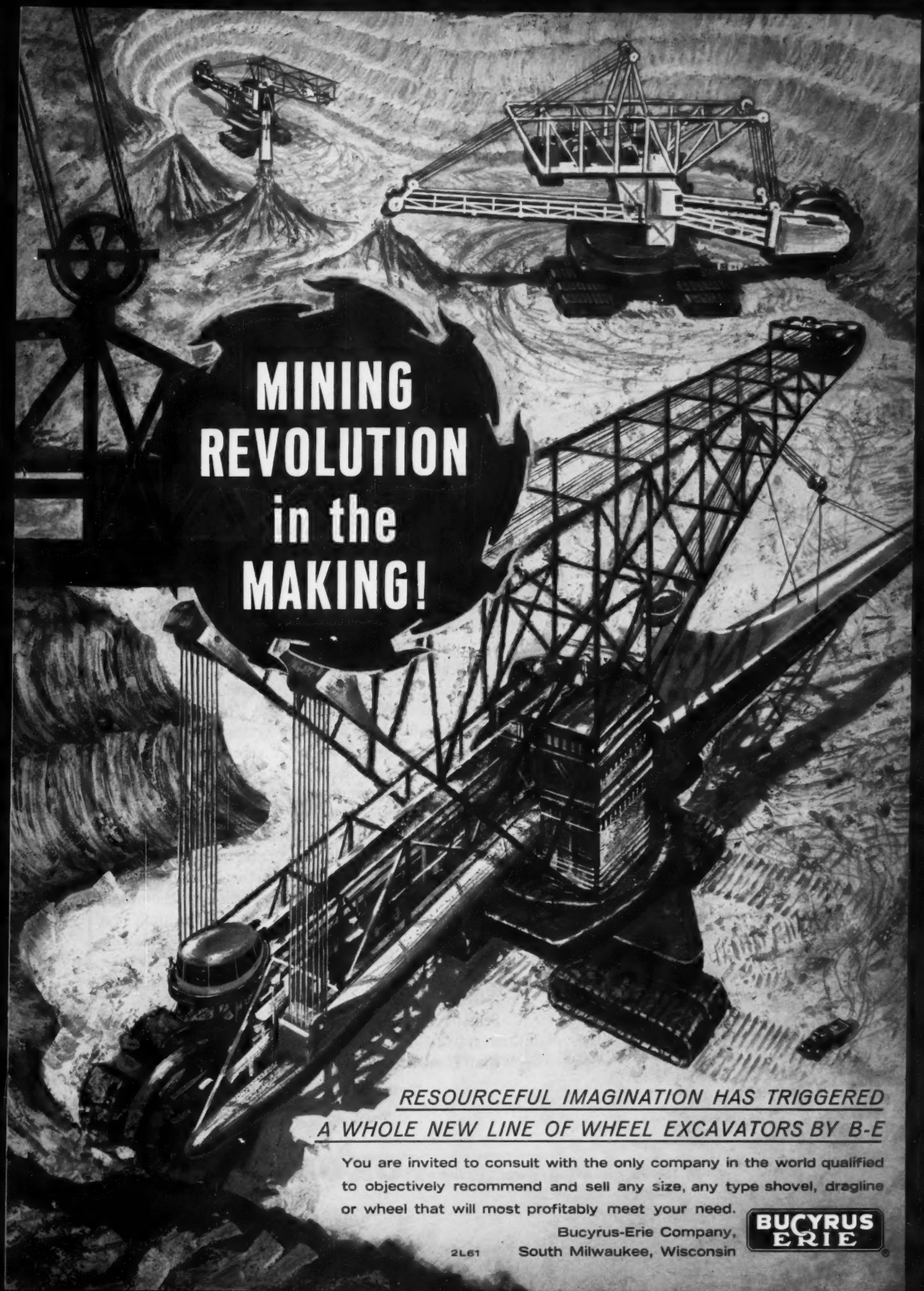
THE SOUTHEAST CHAPTER OF THE AIME held its April meeting at the Thomas Jefferson Hotel in Birmingham, Ala. Guest speaker at the meeting was Ben Harrison (left), assistant auditor, U. S. Pipe & Foundry Co., shown here with J. W. Nicol, manager of mines, U. S. Pipe & Foundry Co. Mr. Harrison's topic was "Taxes and Management." He stressed the necessity for everyday cooperation on tax matters between management, operating personnel and the tax administrators. And he cited several practical examples to illustrate the influence and importance of tax planning on management decisions.

C&O Redesigns Coal Pier

The Chesapeake & Ohio Railway will redesign its Coal Pier 14 at Newport News, Va. When alterations are completed in mid-1962, it will be the largest and fastest coal-loading pier in the world, the C&O announcement reported.

M. I. Dunn, C&O's senior vice president, said "The idea behind this is to expedite the loading of the enormous coal-carrying ships now being built. Pier 14 will be geared to load colliers taking 45,000 or more tons, replenish their fuel, water and supplies and finish the job in about 8½ hr from arrival to departure."

Pier 14 is presently capable of loading



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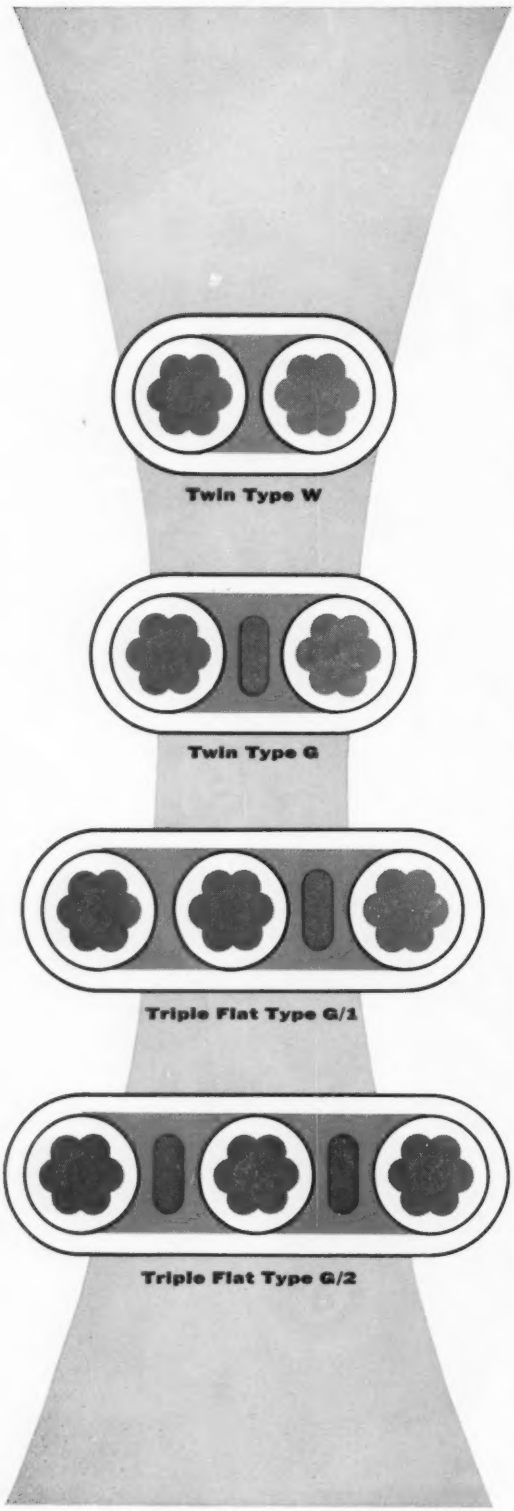

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For SHUTTLE CARS and MINING MACHINES ...a-c or d-c

designed to resist constant flexing, pulling, twisting and accidental damage between conductors.

Get longer cable life and cut downtime on shuttle cars and mining machinery by specifying Okocord Red Saddle flat type cable for *your* equipment. This special construction has proved its reliability through years of rugged service in mines across the country.

The insulated conductors are separated by a red preformed Okoprene filler—Red Saddle. This flame-resistant, protective wall acts as a cushion between the conductors, providing extra security against short-circuiting during crushing or run-overs. Red Saddle provides an additional safety feature by preventing the propagation of flame in case of short-circuiting of the conductors.

The entire assembly of this streamlined portable cable is covered with a strong, nylon open braid reinforcing, locking it tightly together. This construction adds additional strength against excessive pulling or twisting. The overall jacket is Okoprene . . . a tough abrasion resistant, yet highly flexible neoprene compound. It offers maximum resistance to flame, oils, acids, alkalies and water. Of course, all Red Saddle Okocords meet the Bureau of Mines flame-resistance test.

Send for a sample of any of the constructions shown here, and get full details about Okocord Red Saddle Cables. Write: The Okonite Company, Passaic, N. J.

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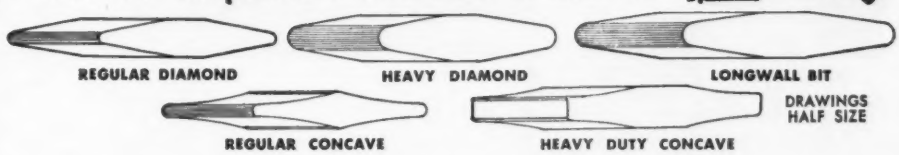
There are **5 TYPES, 3 TEMPERS MEDIUM, TOUGH & HARD**



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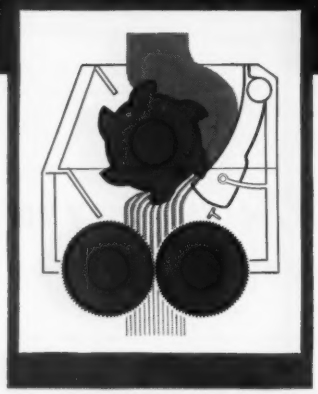

More uniformly-sized product results from this two-stage combination: Large-diameter toothed roll does the primary work against a curved crushing plate; with double rolls performing the secondary reduction.

The McLanahan Triple Roll Crusher . . . which reduces run-of-mine coal and open pit feed to ½" and smaller in a single pass . . . has been refined to make it even more adaptable for high-tonnage operations. Rolls now are gear driven, and larger size rolls are available.

NOW AUTOMATIC TOGGLES, an optional feature, protect against tramp iron. Attached to the movable secondary roll, the Toggles open to pass uncrushable material, then immediately return the roll to the original setting—without stopping the crusher.

Ask for New Bulletin TR-20.

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the largest coal ships now in service or a building, and can load four vessels at one time. The improvements will enable C&O to load such vessels in one-third the time it takes with present equipment. Conveyor belts move the coal between the four dumping machines and the loading towers.

Safety

The Joseph A. Holmes Safety Association has awarded Medals of Honor to two coal miners who risked their own lives in efforts to save the lives of others.

Hillary Miracle, employed as a coal miner by Harlan Collieries Co., Brookside, Ky., saved the life of Rufus J. Bailey last May 17 during a serious mine fire. Mr. Bailey, though wearing a gas mask and unhurt, was trapped by falling roof when Mr. Miracle, who had arrived at the fresh air base in the mine and donned a gas mask, groped his way forward until he saw Mr. Bailey's cap light. Working together the two men extricated Bailey and once he was freed, joined in fighting the fire. Mr. Bailey is safety director of Harlan County Coal Operators' Association.

Wayne J. Rose, a bulldozer operator at Clinchfield Coal Co.'s Moss No. 2 Mine near Cleveland, Va., received the Medal of Honor for his part in rescuing a 13-yr-old boy from drowning April 22, 1960. The boy, Julian Quail Simerly, was caught in a whirlpool while swimming in Chaney Creek, Va. Mr. Rose and French Dinsmore, a professional golfer, dived repeatedly into the icy water before they found the youngster and pulled him, unconscious, to shore. For more than an hour they applied artificial respiration until the boy's breathing was restored.

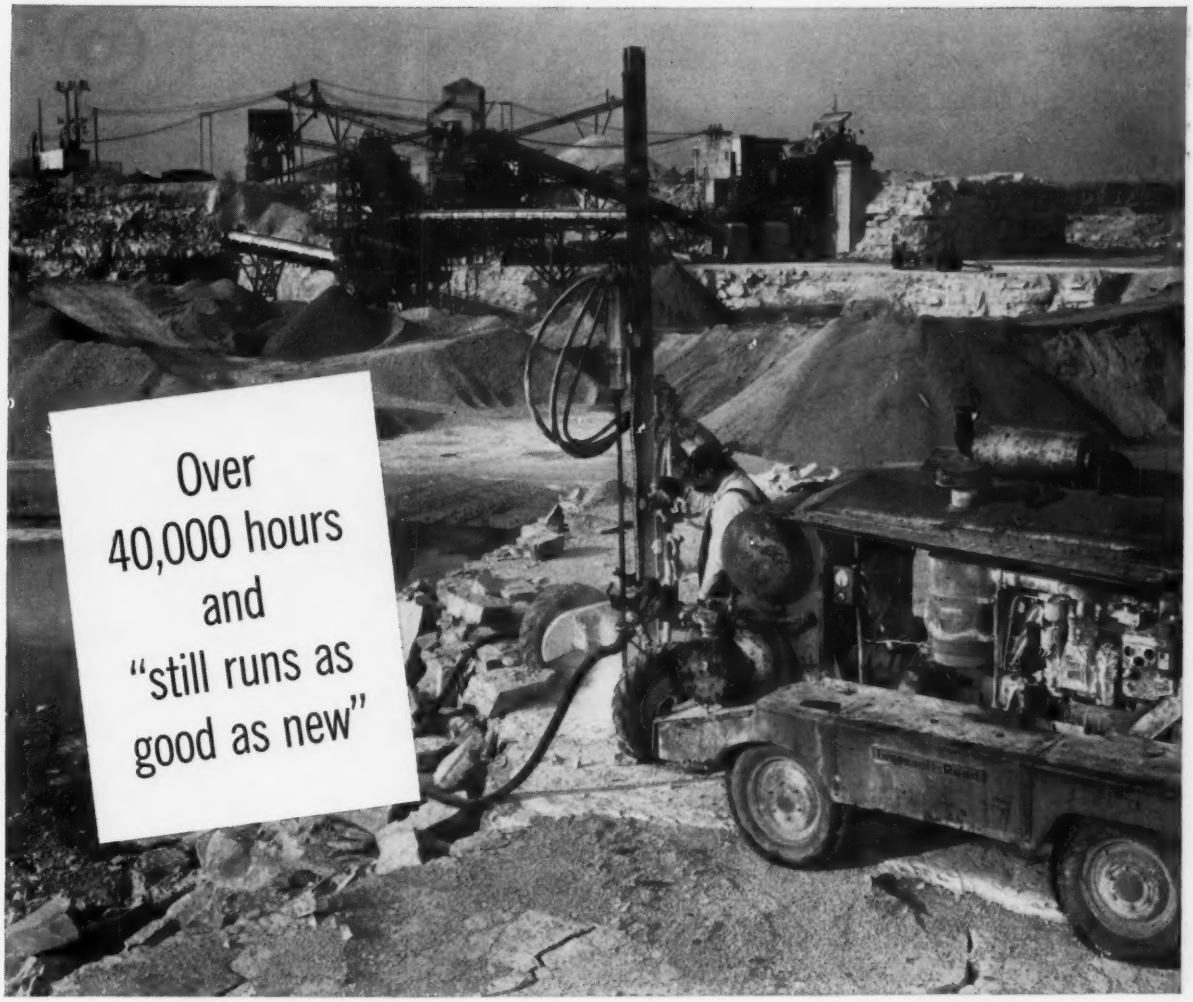
Federal investigators have blamed the deaths of 22 Indiana coal miners last March 2 on a gas explosion touched off by an electric spark or an open flame.

But the final report prepared by the Bureau of Mines officials left open the possibility that smoking by miners may have played a part in the underground explosion. "Smoking underground evidently was common practice" in the Viking Mine of the Viking Coal Corp., Terre Haute, Ind., where the 22 men died, the report said. "Smoking was not observed underground at the time of the last federal inspection (in December)," the report stated. "However smokers' articles were listed among the personal effects of many of the explosion victims including the foremen."

Utilization

Two companies plan a joint project to build a plant in Midvale, Utah, for the conversion of the highly-volatile

GET REAL PRODUCTIVITY—GET A GM DIESEL



One look will tell you that this Ingersoll-Rand 315 Gyro-Flo compressor has had to work for a living.

And worked it has!

For over 9 years it has been on the job day in, day out, supplying air for drills and hammers in the Halquist Lannon Stone Company quarry near Sussex, Wisconsin.

In those nine years this GM Diesel powered unit has racked up over 40,000 hours—*been overhauled only twice* at approximately 18,000-hour intervals.

Mr. A. C. Halquist says, "The GM Diesel 3-71 in this compressor has had only minor adjustments in addition to two overhauls and still runs as good as new. It's one of the best pieces of equipment we ever bought."

If that's the kind of profit-making productivity you want from your equipment, specify a GM Diesel engine when you buy or repower. There's a model of the proper size and output for nearly every type of construction equipment.

For details see your GM Diesel Distributor* or write direct for your copy of the new booklet, "2300 Applications of GM Diesel Power."

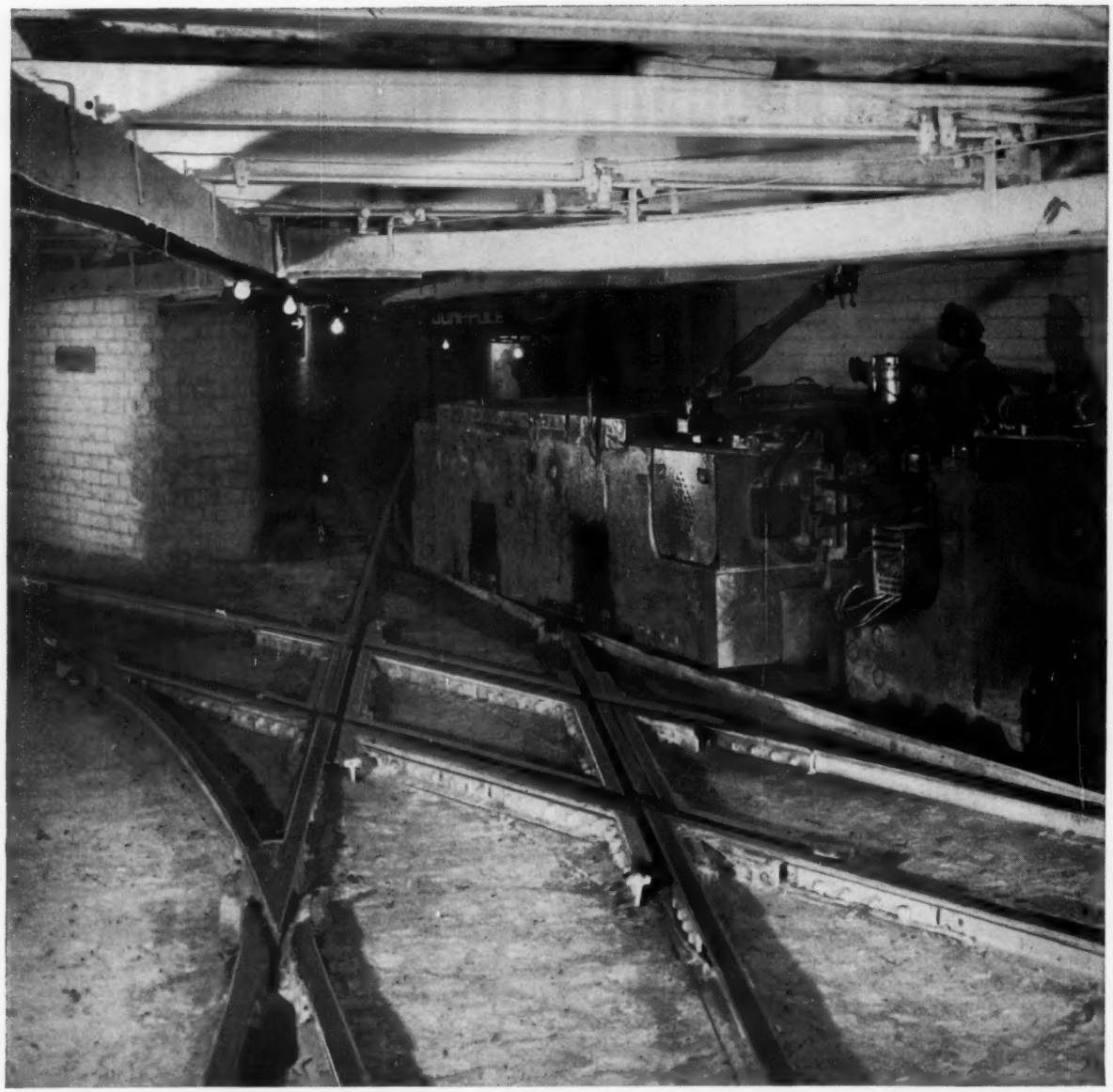
**Listed in the Yellow Pages under "Engines, Diesel."*

GM DIESEL

DETROIT DIESEL ENGINE DIVISION,
GENERAL MOTORS, DETROIT 28, MICH.

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario
Parts and Service Worldwide

GM DIESEL ALL-PURPOSE POWER LINE sets the standard of Diesel productivity



Where your operating requirements call for a complicated layout like this, you'll value the extras you get in the "Bethlehem approach." And in the long run, Bethlehem-designed and prefabricated trackwork costs less than the do-it-yourself kind.

Here's how we prefabricate track

For Strength
. . . Economy
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Steel

To begin with, one of our engineers will visit your workings. There he will absorb all you tell him about your operations, both present and proposed. Then he'll return to Bethlehem and huddle with our mine-track specialists. Plans will be drawn up for your approval.

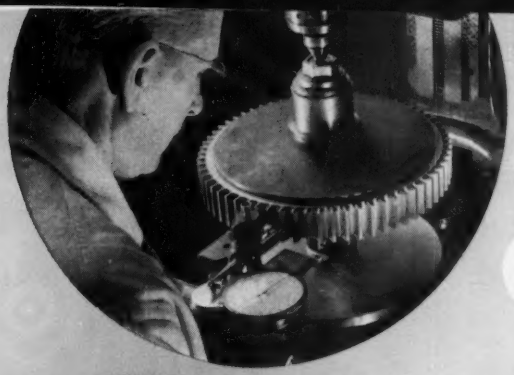
Next, all rail material will be prepared including precutting, curving, and match-marking against the plans. All components will be assembled on our layout floors to be sure of perfect fitting. When the order arrives at your site, everything will fit smoothly into place without waste or worry.

This is the way to be sure you're on the right track. And this is the way more and more mines are improving their haulage systems, and lowering operating costs. We're ready to start working with you right now. A phone call or note will start things moving.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Sales:* Bethlehem Steel Export Corporation

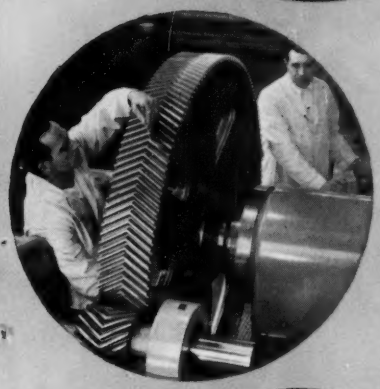
BETHLEHEM STEEL

BETHLEHEM STEEL



These men are making certain of

QUALITY in ILLINOIS GEARS

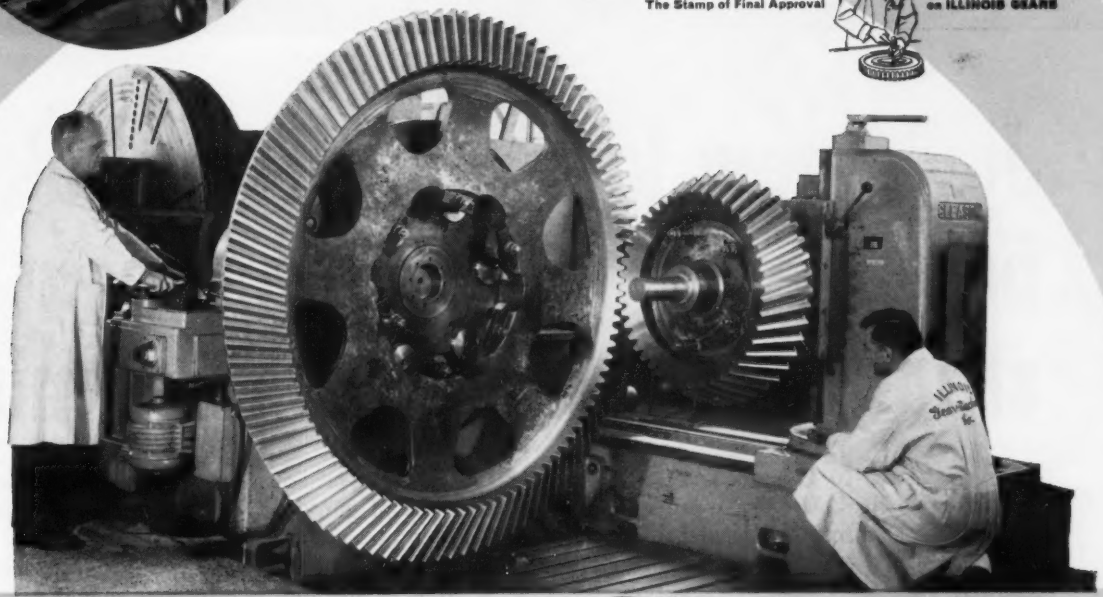


A vital factor in the outstanding performance of ILLINOIS GEARS is the painstaking, unyielding control of quality by skilled craftsmen equipped with the very finest and most modern facilities obtainable.

So exacting is this control of quality in every step of manufacture that it has become a tradition at ILLINOIS GEAR . . . a tradition so deep rooted it has added the *extra dimension of perfection in quality* in every gear.

Whatever your requirements in gears are it will pay you to find out about gears that are made right with quality as the first consideration.

The Stamp of Final Approval on ILLINOIS GEARS



Look for this mark ILG® . . . the symbol on finer gears

ILLINOIS GEARS Reg U.S. Pat. Off

Gears for Every Purpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

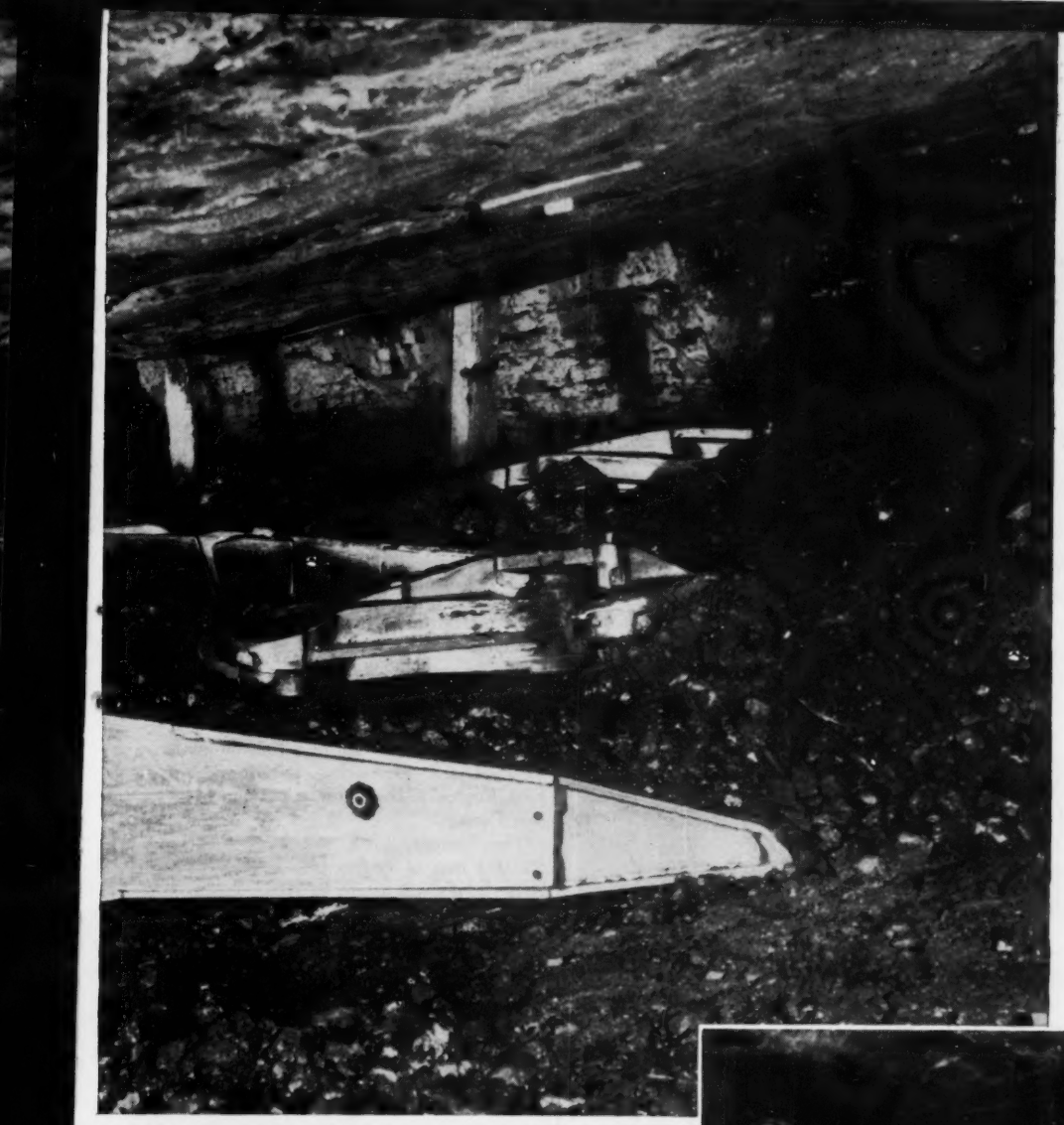
2108 NORTH NATCHEZ AVENUE • CHICAGO 35, ILLINOIS

Joy's new low seam team takes bad bottom and pitching seam in stride at Inland's Price No. 2 mine

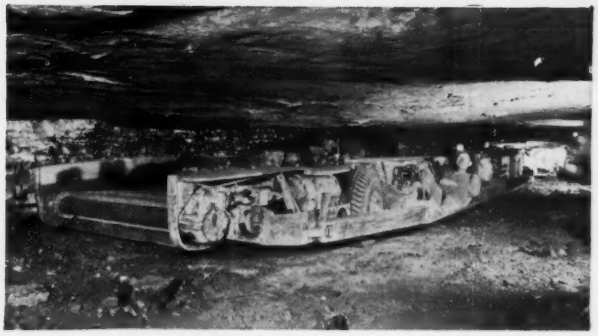
The Joy 14-BU-10 Loaders and 18-SC Shuttle Cars at Price No. 2 Mine have proven capable of loading out coal in conditions that are very severe. The seam is undulating and at times pitches sharply. To these impeding conditions must be added the difficulties imposed by thinness of seam—27″ to 33″.

Under such severe conditions, the Joy 18-SC 6-wheel Shuttle Car has advantages that permit it to outperform the normal or conventional type 4-wheel shuttle car. The Joy loader-buggy team is moving coal at rates comparable with performance of conventional equipment under more favorable conditions.

If you are interested in raising production in thin or medium seams, you should investigate this new loader-buggy team from Joy. Your Joy representative will be glad to discuss your problems and recommend the team best suited to your conditions. Joy 14-BU-10 Loaders and 18-SC Shuttle Cars are available in three basic machine heights.



Undulating, sharply pitching seam at Inland's Price No. 2 Mine, with poor bottom, created conditions which would impede a less powerful loader than the new Joy 14-BU-10.



Joy's new 18-SC 6-wheel Shuttle Cars provide more haulage capacity than conventional 4-wheeled buggies in thin seams such as the 27″-33″ seam at Price No. 2 Mine—especially where the seam is undulating or sharply pitching and where bottom may be soft.

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING MACHINERY

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

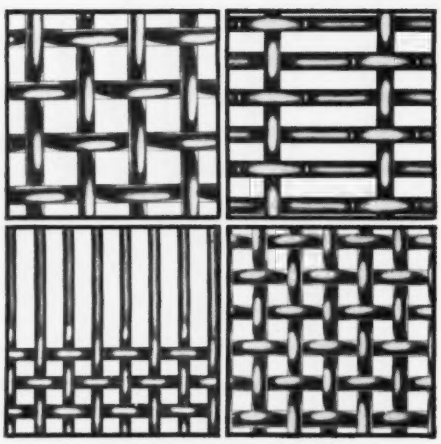
In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

WHY TAKE LESS?

The "industry's finest" costs no more but delivers the greatest bargain you can buy in longer, tougher resistance to abrasion, distortion, fatigue and breakage.

YOU GET MORE with Ludlow-Saylor Screens in uniformly better products, increased output, savings in downtime and labor, plus tremendous economy in replacement screen expense. Don't take less—order, insist on, Ludlow-Saylor Screens.

LUDLOW-SAYLOR
WOVEN WIRE SCREENS



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IMMEDIATE DELIVERY . . .
most weaves and sizes

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L-S Screens and Wire Cloth can be furnished in any steel including high carbon, oil-tempered, stainless or other alloy; in Monel, bronze, copper, brass and most other metals that can be drawn into wire.

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STAR WIRE SCREEN & IRON WORKS, INC. (L-S Subsidiary)
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western coals to metallurgical coke.

The U. S. Smelting, Refining & Mining Co. and the Victor Chemical Div. of Stauffer Chemical Co. are the two companies involved. Victor plans to use coke from the plant at its elemental phosphorus furnace at Silver Bow, Mont. It is expected that the retort will be completed by the year end. Operation will be based on a new process developed by Loran A. Craglow, director of research for U. S. Smelting and its subsidiary, U. S. Fuel Co.

A year ago the company announced completion of a small pilot plant which successfully produced a pelleted coke hard enough to be used in elemental phosphorus or similar metallurgical uses. This is the second major announced attempt to produce on an economical basis metallurgical-grade coke from the highly-volatile soft western coals.

Ground was broken April 22 near Burnside, Ky., in ceremonies symbolizing start of construction of a 100,000-kw steam-electric generating unit for the East Kentucky Rural Electric Cooperative Corp.

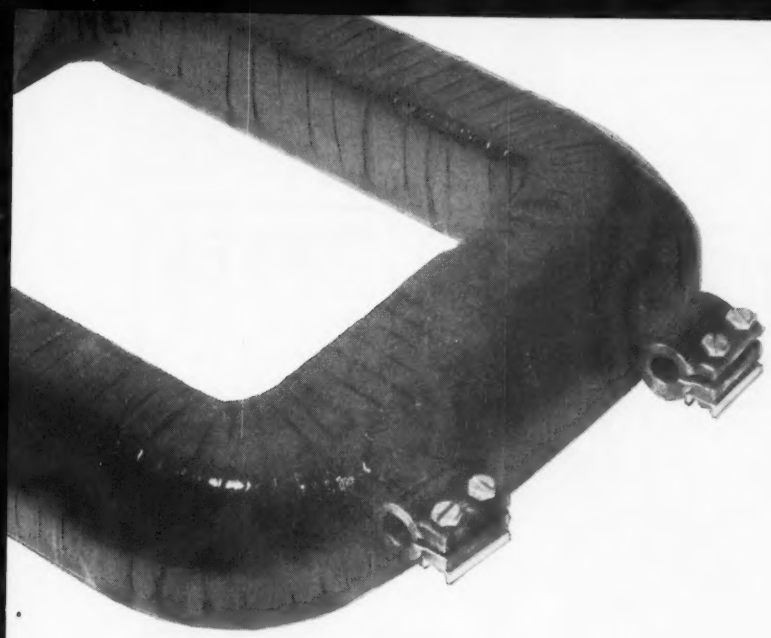
The Burnside plant will burn about 250,000 tons of coal a year initially to come from southeastern Kentucky mines. Cost of the generating plant, substations and 315 mi of transmission lines is estimated at $25 million to be financed through Rural Electrification Administration loan.

Bids opened May 4 in Cheyenne, Wyo., for the lease of 4,360 acres of federal land bearing low-grade coal. The acreage involves three tracts—one, 1,520 acres, another, 1,478½ acres and a third with 1,361½ acres—located 18 mi north of Glenrock, Wyo.

Ed Pierson, Bureau of Land Management supervisor, said J. C. Kircher, representating a Dallas, Tex., company, had asked for the lease on the low-grade coal. A $1 million outlay in plant facilities would be made to extract chemical products from the coal, Mr. Kircher stated. Between 300 and 500 tons would be processed daily if the Kircher interests get the leases.

According to Mr. Pierson, royalties would be 15¢ on each ton of coal plus the rentals submitted by the highest bidder.

Late note: Mr. Kirchner was awarded the leases. He said mining operations would be started within a few weeks and a large commercial fertilizer plant built. A newly-developed chemical process, details of which he would not now reveal, will convert the coal into concentrated humus pellets about the size of a grain of salt. According to Mr. Kirchner, a pound of these pellets will be equivalent to the fertilizer value of 1,000 lb of barnyard manure.



many mine locomotive RENEWAL PARTS may

LOOK ALIKE
FEEL ALIKE
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BUT they don't perform alike. Only General Electric certified Renewal Parts are designed to maintain the perfect balance of the entire mechanical and electrical system of a General Electric mine locomotive. System design and craftsmanship assure that each part does its job efficiently and effectively . . . and makes a positive contribution to every related part in the system. Since each G-E part is made specifically for General Electric mine locomotives, there is no need for design compromise. Proper system performance will save your maintenance dollars.

For information on parts and maintenance problems contact your local G-E sales representative or write to General Electric Company—Locomotive & Car Equipment Department—Building 12—Erie, Pa. 121-05

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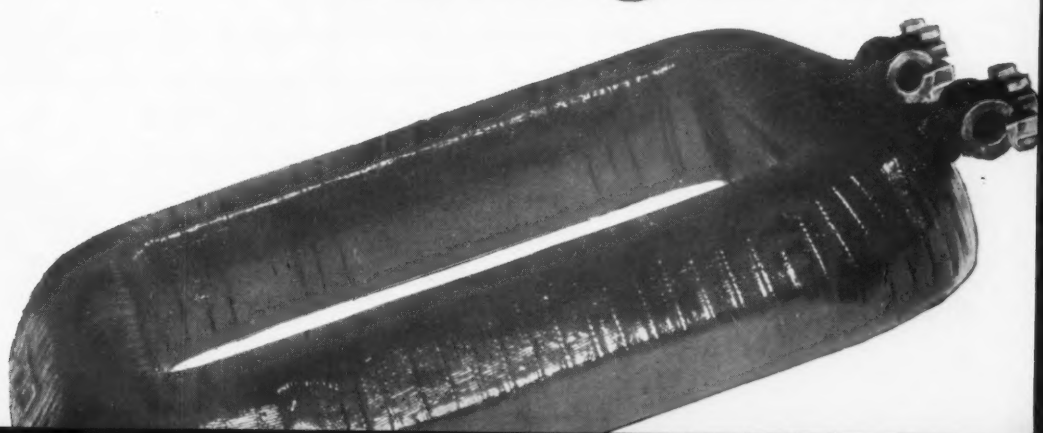

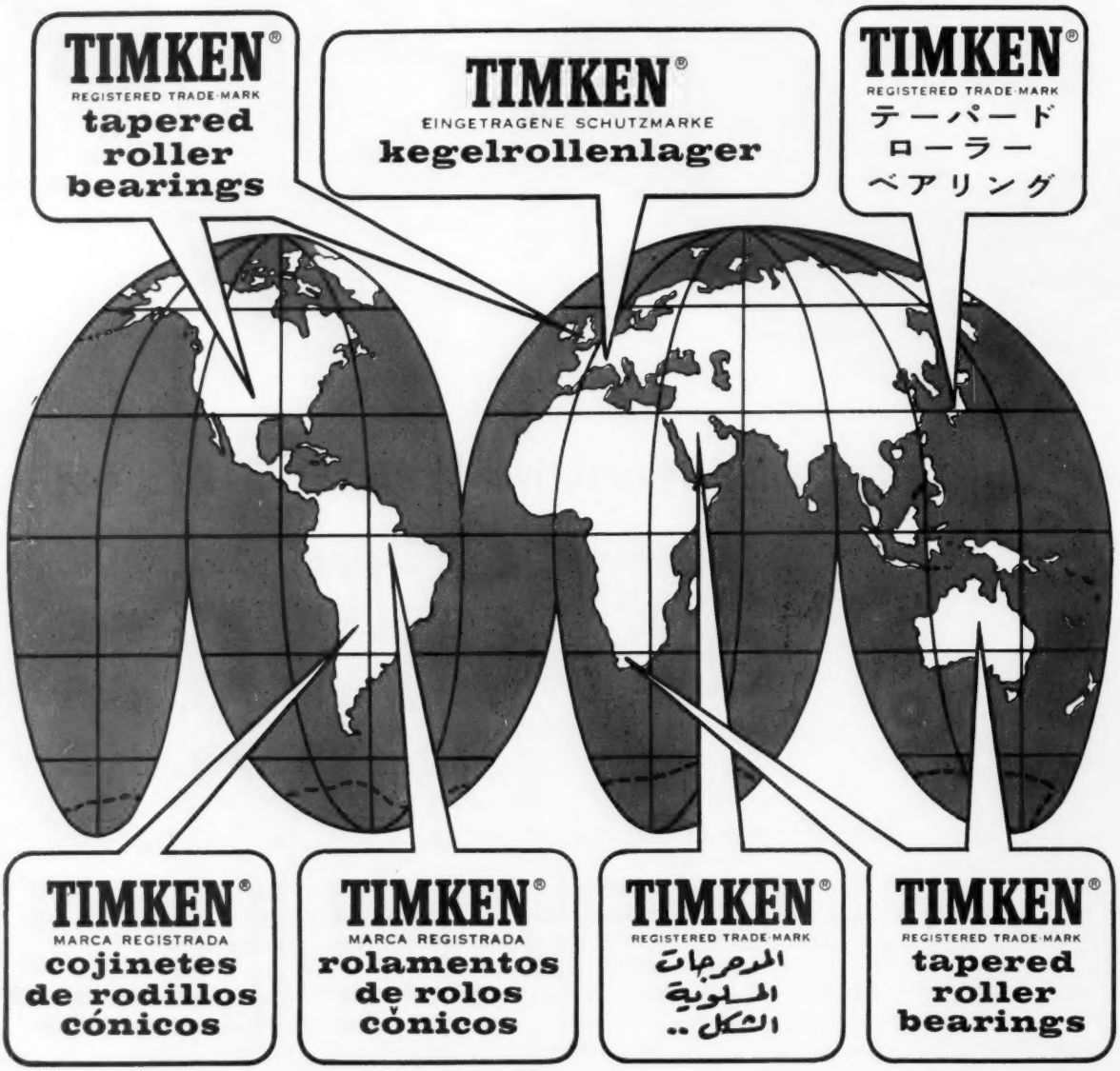

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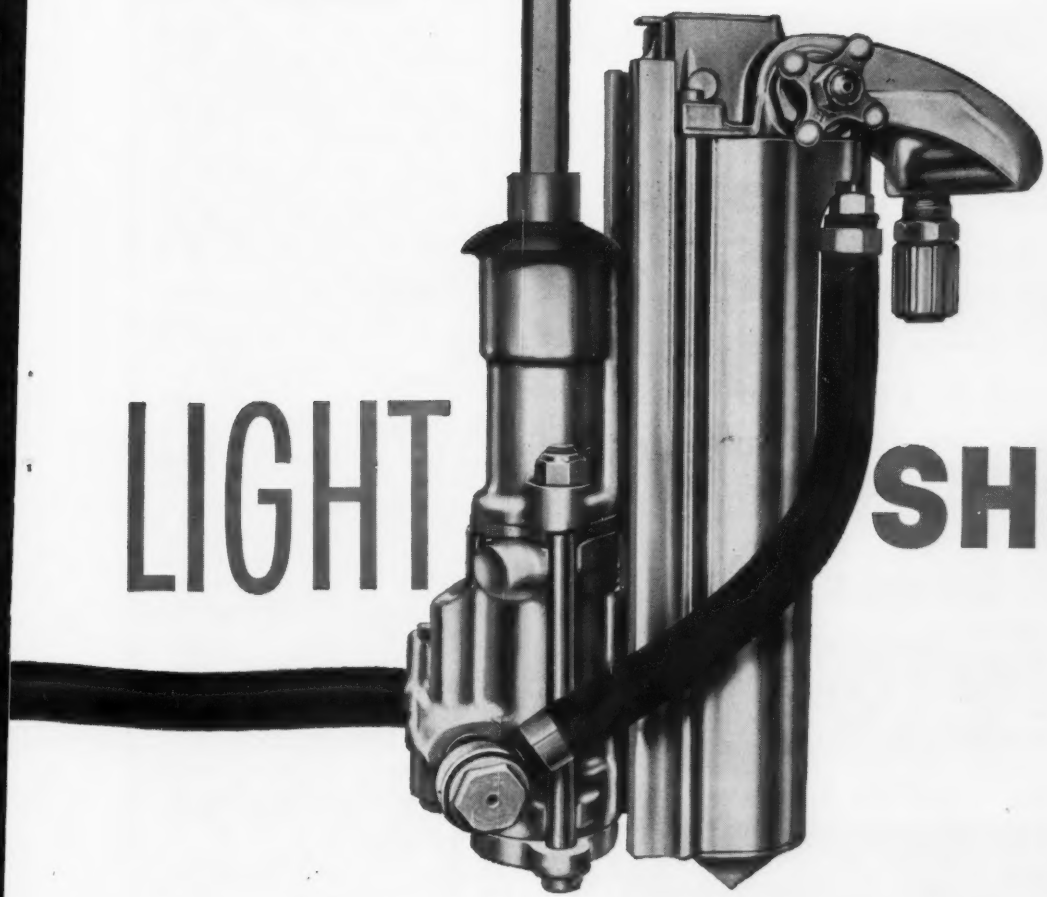
And when you buy Timken bearings, you're assured of the engineering service of the world's most experienced and largest manufacturer of tapered roller bearings. The name "Timken" is a trade-mark identifying the bearings, steel and rock bits made by The Timken Roller Bearing Company and its subsidiaries and divisions the world over. The Timken Roller Bearing Company, Canton 6, Ohio, U.S.A. Cable address: "TIMROSCO". Timken bearings manufactured in U.S.A., Australia, Brazil, Canada, England and France.

"DUSTLESS" S 20 STOPER is available with 28-, 46-, and 64-in. feeds... weights; 65, 78, and 88 lbs. It can be used for fast, dustless roof-bolting wherever a man can crawl!



LIGHT SHORT

LE ROI S 20 STOPER DUSTLESS

• drills in 26-in. coal • delivers lightweight power • cuttings never pass through stoper

The thousands used in coal mines prove that the Le Roi S 20 Dust-Collecting Stoper is the shortest, lightest, and the only practical stoper for 26-in. seams!

Le Roi's Vac-Nu-Matic® dust-collection is fast, positive — reduces wear on men and machines. Perfect dust removal minimizes rotational drag, eliminates stuck steel, and speeds drilling even in soft, wet formations. The S 20 removes dust through the chuck housing — not through the stoper — drills deeper with one steel change than conventional stopers can with two! Its design permits chuck changes without dismantling the machine.

Call your Le Roi distributor for more information—and a demonstration. Or write to Le Roi Division, Westinghouse Air Brake Co., Sidney, Ohio.

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PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

Distributed in the Coal Fields by: Acme Machinery Company, Huntington, West Virginia, and Equipment Service Company, Inc., Birmingham, Alabama.

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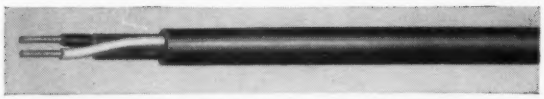

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Remote Control and Drill Cords

PORTABLE CORDS . . .

Portable Power Cable, Twin Type G (Hex-Shaped Parallel Conductors)

Locomotive Gathering Cable

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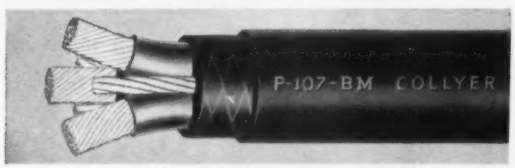
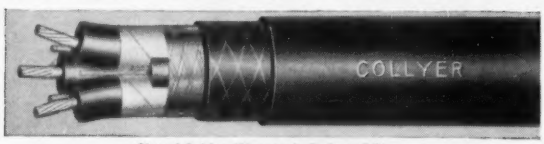


Portable Power Cable 2-4 Conductor Type G 2-6 Conductor Type W



Shovel Cables (Classes A, B, C, and D)

Concentric Mining Machine Cable

Collyer Portable Cords and Cables fill a thousand and one needs . . . above and below ground . . . for light, medium and heavy duty applications such as power tools, shop machinery, welding apparatus, mining equipment. Collyer's capacity and know-how can meet *your* construction and service specifications . . . including resistance to flame, oils, solvents, moisture, crushing, flexing, abrasion. In every case, you'll find Collyer Portable Cords and Cables easy to install, longer-lasting, trouble-free.

For specifications, quotations, or engineering assistance, write

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Equipment Approvals

Jeffrey Mfg. Co.—Type MT-67 shuttle car with electrical conveyor drive; six motors, three 25- /22-hp, one 25-hp and two 15-hp, 440V, AC. Approval 2F-1627A, Apr. 3.

Jeffrey Mfg. Co.—Type ML-81-AHW crawler-loader; four motors, two 25- /12.5-hp, one 20-hp and one 4-hp, 440-V, AC. Approval 2F-1628A, Apr. 4.

Joy Mfg. Co.—Type X855-46 mobile bridge conveyor; one motor, 50-hp, 250-V, DC. Approval 2F-1629, Apr. 4.

Ensign Electric & Mfg. Co.—Type IM distribution box; 800-amp, 250-V, DC. Approval 2F-1630, Apr. 11.

Nolan Co.—Model EH-1 automatic loading station; one motor, 30-hp, 250-V, DC. Approval 2F-1631, Apr. 13.

Joy Mfg. Co.—Type 6PM-2AN continuous miner; eight motors, two 100-hp, three 25-hp, one 30-hp and two 15- /30-hp, 500-V, AC. Approval 2F-1632A, Apr. 14.

Lee-Norse Co.—Model CM32-1 K/M miner; three motors, each 50-hp, 250- /550-V, DC. Approvals 2F-1633 and 2F-1633A, Apr. 14.

Lee-Norse Co.—Model CM32-IE continuous miner; three motors, each 50-hp, 440-V, AC. Approval 2-F1634A, Apr. 17.

Galis Electric & Machine Co.—Model 410 face drill; one motor, 30-hp, 440-V, AC. Approval 2F-1635A, Apr. 17.

Jeffrey Mfg. Co.—Type MM-100-L miner with 94-D or L conveyor; three motors, one 50-hp and two 2-hp, 250-V, DC. Approval 2F-1636, Apr. 17.

Kersey Mfg. Co.—Model P-1144 battery-powered utility truck with winch; three motors, two 15-hp and one 5-hp, 96-V, DC. Approval 2F-1637, Apr. 18.

Joy Mfg. Co.—Type 5CM-5AHH continuous miner; seven motors, two 100-hp, two 15-hp, one 30-hp and two 7.5- /15-hp, 415-V, AC. Approval 2F-1638A, Apr. 24.

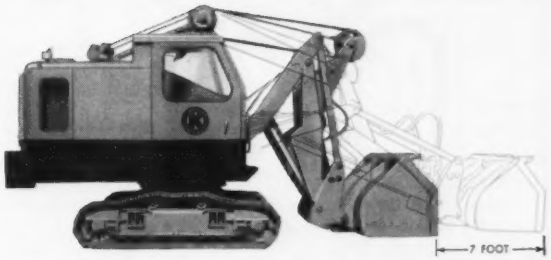
Goodman Mfg. Co.—Type 1070-10 shuttle car; two motors, one 75-hp and one 10-hp, 440-V, AC. Approval 2F-1639A, Apr. 25.

Greengate & Irwell Rubber Co., Ltd., Great Britain—Acceptance designation "Fire Resistant U.S.B.M. 28-30" assigned to identify conveyor belts accepted as fire resistant.

"SKOOPER Loads Cleaner Coal at Higher Speeds"

Says Atlee Mullet
President of Mullet Coal Co.
Mt. Eaton, Ohio

"Skooper has the speed and big capacity we need in our loading-out operations. And its flat, crowding action pulls away cleaner coal every time . . . clay and other material under the seam stays put. We used to use a 1½-yd. shovel. Skooper not only loads out faster but saves us money because of its high production and cleaner delivery of our product."



Ask your Koehring distributor to show you what the Skooper can do to give you better coal-loading output. See him soon.

There's Nothing Like It On Wheels or Tracks

KOEHRING
DIVISION OF KOEHRING COMPANY
Milwaukee 16, Wisconsin

K119

DISTRIBUTOR DAN, the SKF bearing man, offers

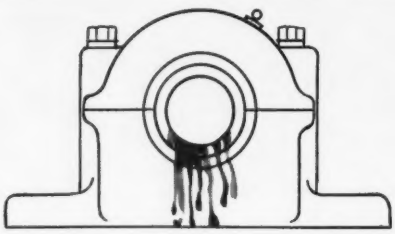
FIVE TIPS ON BEARING LUBRICATION

—that can save time and trouble for you

WHEN TO RE-LUBRICATE? Always follow the manufacturer's directions, if they're available. Most bearings, whether oil- or grease-lubricated, need cleaning and re-lubrication once a year. Re-lubricate oftener if the bearing is large, operates at high speeds or temperatures of 120-140 F. or higher.

WHAT GREASE CAN TELL YOU. Grease itself can tell you when cleaning and re-lubrication are needed. Dark grease means that oxidation has started or that abraded particles are present. Changes in the original color indicate water. Grease of a hard consistency should always be replaced.

WHEN TO CHANGE OIL. Compare the oil in the bearing with unused oil. Clouded oil indicates water. Dark oil frequently indicates sediment. Dark, pitch-like coatings on the rings, roller ends or cage mean the oil has become dirty or begun to carbonize. So, clean the bearing and housing and re-lubricate.



TOO MUCH IS WORSE THAN TOO LITTLE. Don't overlubricate. Only grease that actually contacts the bearing lubricates. Using too much grease may cause churning and lead to overheating and loss of lubricant. Remember: the higher the speed, the more sensitive a bearing becomes to excessive lubrication.

CLEANLINESS, FIRST AND LAST. Clean new oils and greases will usually force-out old lubricants in the bearings. But they won't if the lubricant is badly oxidized. Pour a hot aqueous emulsion into the housing. Rotate shaft until bearing is clean. Drain solution while rotating shaft. Then, flush with hot light oil, drain and add new lubricant.

Baffled by a bearing problem? Whether it's selection, mounting, or maintenance — consult your Authorized SKF Distributor. He's staffed to help you keep them running smoothly and he stocks all the bearing types and sizes you need.

SKF

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6019

SKF MOTION ENGINEERING

Advanced ball and roller bearing technology

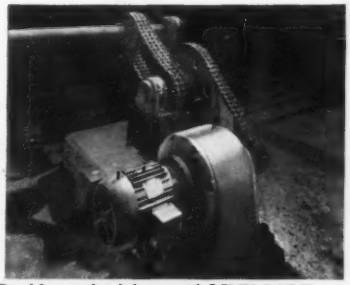
Another of the
invisible extras that
insure the precision performance
of LINK-BELT roller chain

Optical comparator inspection guarantees

precision of every part

Precision is *rigidly practiced* in every step of Link-Belt's roller chain production. The optical comparator is an example of the specialized equipment used to assure precise manufacturing control of chain parts and tools. It is capable of magnification up to 100 times.

Continuous inspection is just one of the *invisible extras* that contribute to the greater strength and endurance of Link-Belt roller chain. Others include precise heat-treat control, prestressing, pitch-hole preparation, shot-peening and burnishing of rollers.



Double- and triple-strand LINK-BELT steel roller chains easily handle the heavy loads encountered by this storage table drive.

These features—plus painstaking precision in every step of manufacture—assure you of chain that can easily cope with today's heavy loads and high drive speeds.

For engineering assistance in applying industry's preferred roller chain, contact your nearest Link-Belt office or authorized stock-carrying distributor. See CHAINS in the yellow pages of your phone directory.

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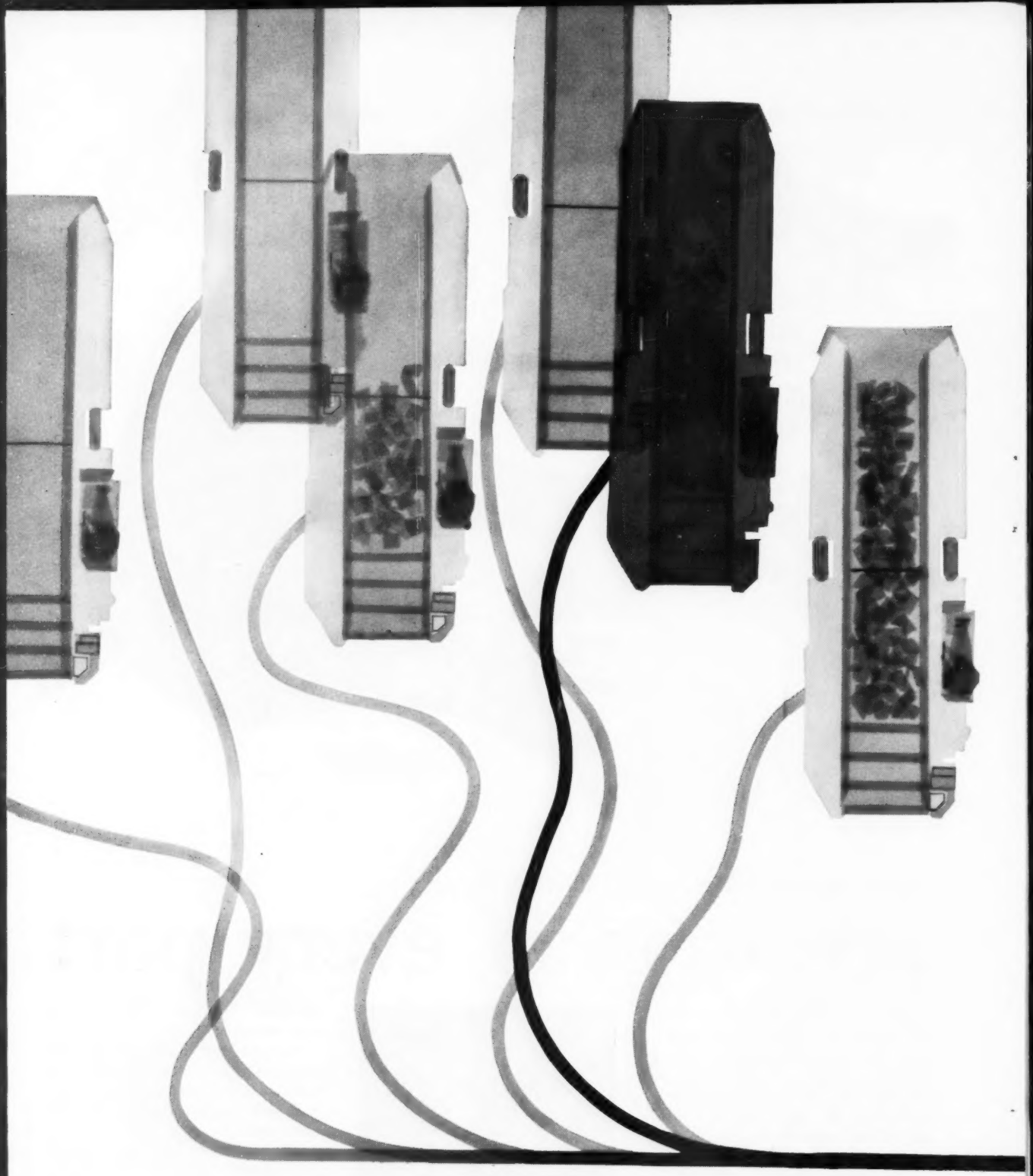
LINK-BELT

ROLLER CHAINS AND SPROCKETS



Why USS Amerclad flat-twin outlasts any other mining machine cable

Only USS Tiger Brand Amerclad flat-twin cable offers the unique "Bridgewall" construction that keeps mine shuttle cars on the job longer. Our flat "Bridgewall" cable actually has a thick layer of neoprene between the insulated conductors and the ground strand. This tough, dense layer of neoprene is part of the outer sheath and locks the conductors and ground strand in place. That's why the jacket of Amerclad cable doesn't get loose and baggy. It will stand up to constant rereeling and twisting, crushing impact, snapping tension, and severe abrasion. No other type of construction is so durable.

Flame resistant neoprene is used exclusively for Amerclad jackets. All of these extra-heavy-duty cables are vulcanized in a continuous lead sheath under pressure to insure a tough, smooth jacket. Concentric stranded conductors, made of the highest quality annealed copper, are carefully prestressed and dynamically balanced to eliminate unequal tension without affecting flexibility. You can't buy better off-track cable.

USS TIGER BRAND Electrical Wire and Cable has a standard cable for every special job . . . for information write American Steel and Wire, Dept. 1172, 614 Superior Avenue, N. W., Cleveland 13, Ohio.

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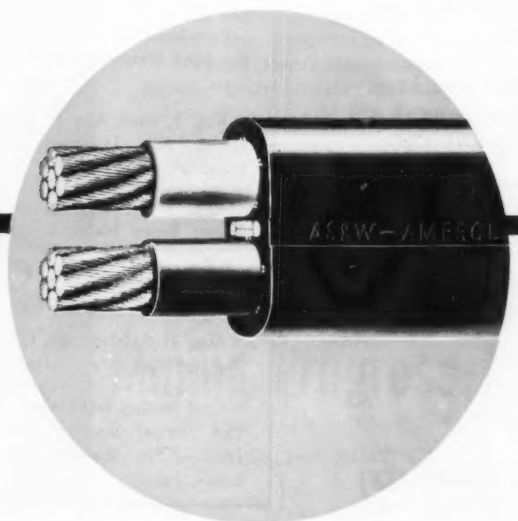

American Steel and Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Alabama, Southern Distributors
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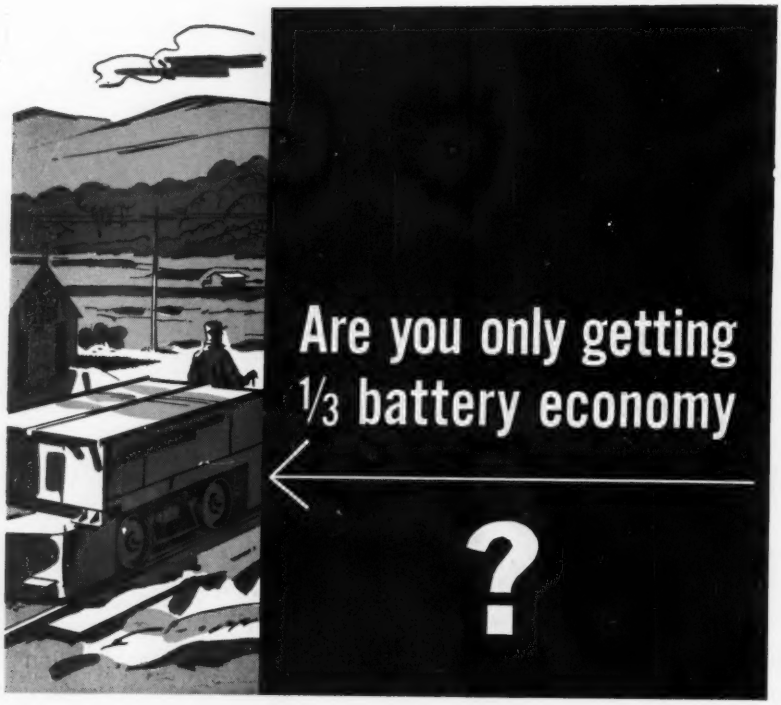

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Coming Meetings

Sixth Annual Appalachian Underground Corrosion Short Course, June 6-8, 1961—West Virginia University, Morgantown, W. Va.

Forty-Fourth Annual Meeting, National Coal Association, June 6-8, 1961—Mayflower, Washington, D. C.

Gordon Research Conferences on Chemistry of Coal, June 12-Sept. 1, 1961—June 12-16 sessions on Science in Preparation of Coal to be held at New Hampton School, New Hampton, N. H. For additional information write W. George Parks, director, Dept. of Chemistry, University of Rhode Island, Kingston, R. I.

Eleventh Annual Short Course in Coal Preparation June 12-July 21, 1961 — West Virginia University, Morgantown, W. Va.

Fifty-first Annual Convention, Mine Inspectors' Institute of America, June 19-21, 1961 — Penn-Sheraton Hotel, Pittsburgh, Pa.

Rocky Mountain Coal Mining Institute Meeting, June 25-28, 1961 — Hotel Colorado, Glenwood Springs.

International Briquetting Association Conference, Aug. 28-30, 1961—Jackson Lake Lodge, Jackson, Wyo.

National First-Aid and Mine-Rescue Contest, Oct. 2-4, 1961—Location changed due to uncertainty in construction schedule of Pittsburgh's new auditorium. New location will be new Civic Center, Charleston, W. Va.

West Virginia Coal Mining Institute, Central Appalachian Section, AIME, Nov. 3-4, 1951—Greenbrier Hotel, White Sulphur Springs, W. Va.

Coal Division Conference, American Mining Congress, Nov. 17, 1961—Penn-Sheraton Hotel, Pittsburgh, Pa. Coal Division Committee Meetings:

Aug. 9, Roof; Aug 10, Mechanical Mining; Aug. 11, Haulage; Daniel Boone Hotel, Charleston, W. Va.

Aug. 22, Coal Prep.; Aug. 23, Power; Brown Hotel, Louisville, Ky.

Aug. 25, Strip; McCurdy Hotel, Evansville, Ind.

Aug. 31, Safety; Sept. 1, Research; Sheraton Park, Washington, D. C.

Coal Mining Institute of America, 75th Annual Meeting, Dec. 14-15, 1961 — Penn-Sheraton Hotel, Pittsburgh, Pa.

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The Latest Installation in West Virginia Is Operating Successfully After More Than Six Months' Continuous Production

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engine power

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Gardner-Denver's new SP900, a 900 CFM machine, is powered, as standard equipment, by the Cat D343 Diesel Engine. The SP600, a 600 CFM machine, is standard with the Cat D333 Diesel Engine. You get four-cycle design with full-stroke efficiency, plus full-length, watercooled cylinder liners for efficient cooling. Aluminum alloy pistons give low reciprocating weight, valve rotators distribute valve face wear and low-friction aluminum alloy bearings are known for superior strength and load carrying ability.

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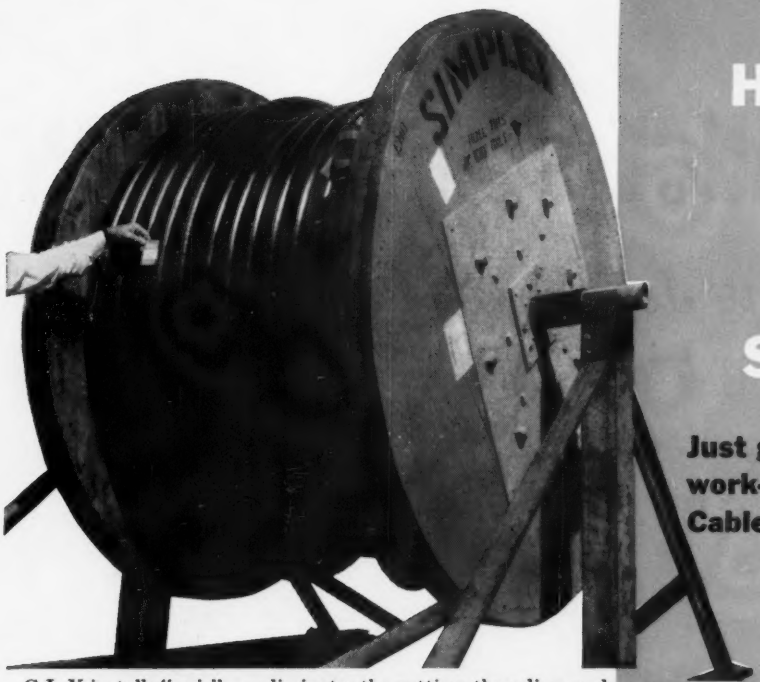

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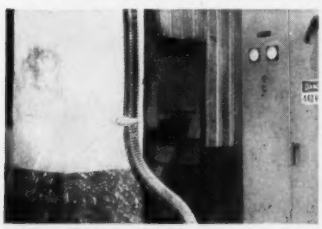

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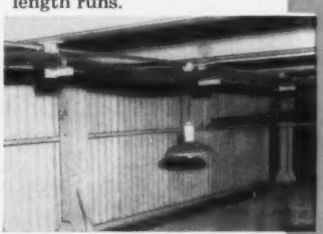
C-L-X is easily trained anywhere, in continuous, long-length runs.

C-L-X installs without the need for benders, sand, elbows, or similar fittings.



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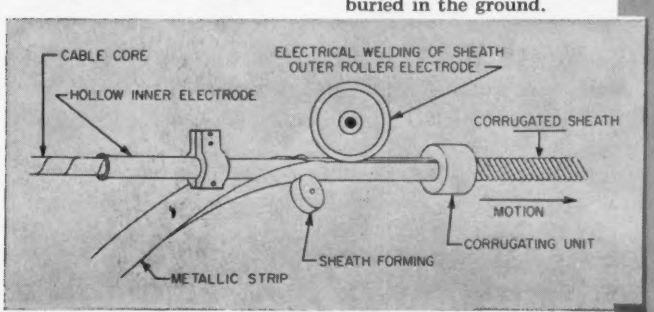

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"We keep ordering Jeffrey equipment because its performance record is outstanding," says Stanley B. Johnson, Jr., *President of The Lorain Coal & Dock Company.*

Following closely behind the Jeffrey cutter is this Jeffrey loader. It's in an 84" seam of Upper Chilton high-grade steam and metallurgical coal.

The Lorain Coal & Dock Company used Jeffrey locomotives and cutting machines as early as 1915 at both its Ohio and West Virginia operations. Within the past two years, their Lorado operations installed four complete Jeffrey conventional mining units at other locations. Each unit includes a cutter, a loader and two shuttle cars. Performance of this equipment has substantially reduced production costs.

Jeffrey welcomes the opportunity to work with you and your engineers on mining development projects. Years of experience with all kinds of mining conditions have given Jeffrey engineers the know-how to assist you in achieving low-cost production, employing the Jeffrey proven line of mining machinery. For this help write your nearest office as listed, or write The Jeffrey Manufacturing Company, 912 North Fourth Street, Columbus 16, Ohio.

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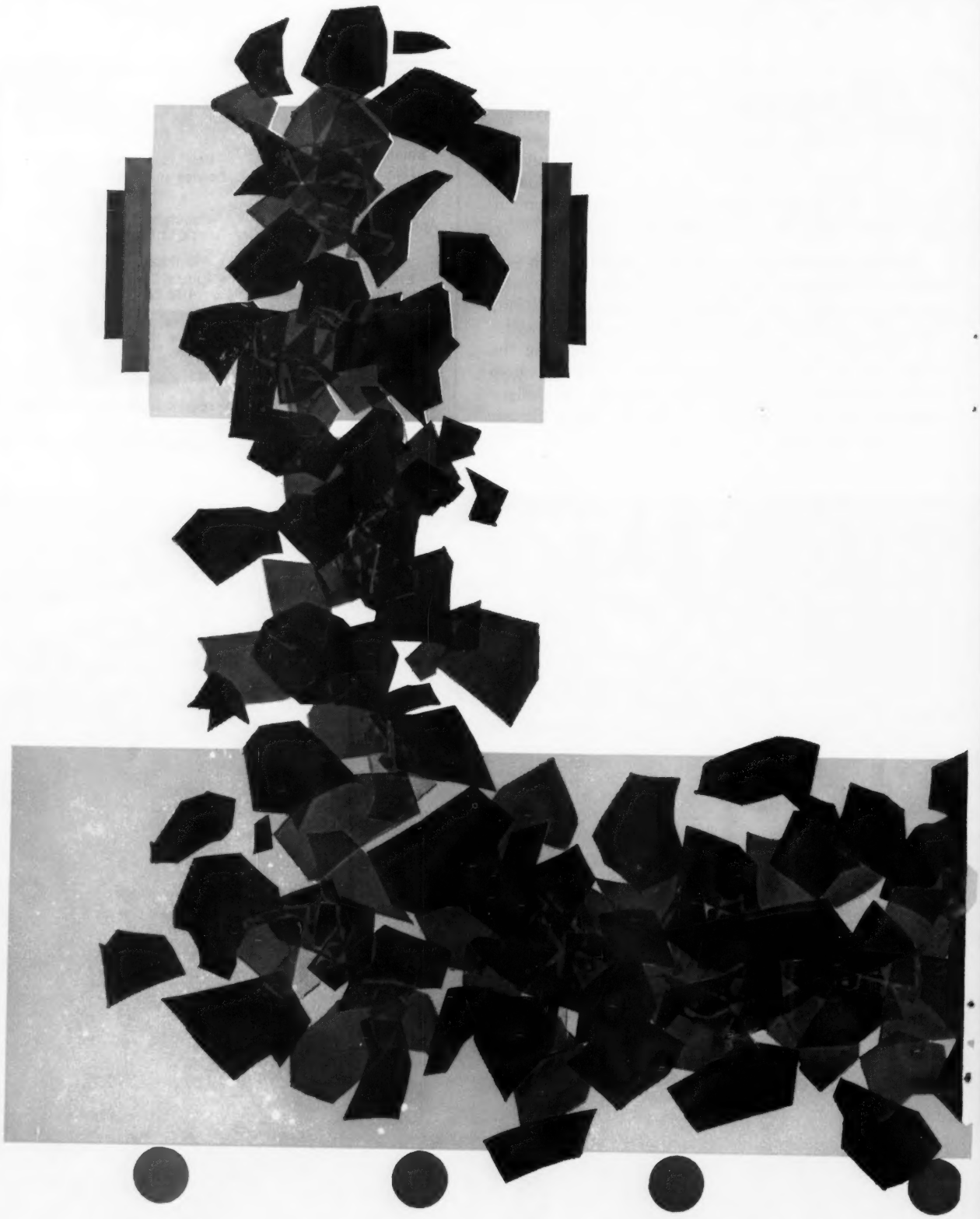
If it's conveyed, processed or mined, it's a job for Jeffrey.

One of eight Jeffrey shuttle cars working with other Jeffrey conventional mining equipment at Lorado, West Virginia.



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NEW THERMOID PLASTICOAL PVC IMPREGNATED BELTING OUTLASTS THEM ALL!

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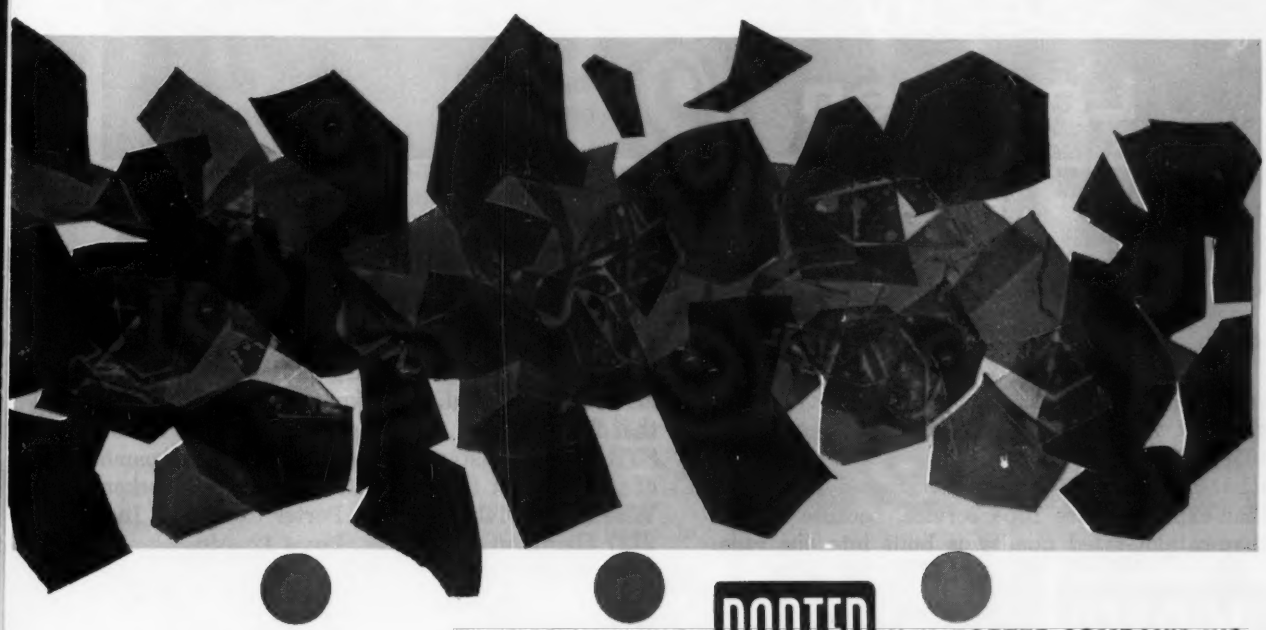

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NEW!

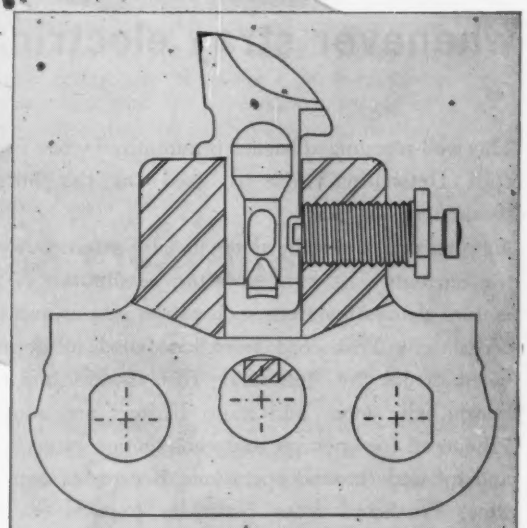
RSS QUICK CHANGE Cutter Bit slashes bit changing time 85%

For fast, easy bit changing, try the new Carmet® RSS Quick Change Cutter Bit with keepers in JOY V-type chains. Simply pry set screw plunger outward to retracted position (cutter bit is released instantly)—remove bit with free hand—replace bit—release plunger. Changing time is reduced 85%! Bit changes are just as fast in Bit Rings and Borer Blocks.

RSS Cutter Bits are designed for positive locking with JOY keepers. The threaded keeper plunger engages a forged notch in the tool shank, keeps the cutting tools locked firmly in place. No wobble, no battering of tool shank on keeper, no tools jerked out and lost.

And the RSS Cutter Bit is built to take abuse . . . with a beefed-up, load-bearing shoulder area that withstands higher cutting pressures . . . a plug-type carbide insert set at an angle that eliminates braze failure and insert loss . . . a full radius tip design that fully supports the insert, reduces breakage, permits harder grades of carbide.

The carbide, of course, is Carmet carbide . . . famous for quality. In fact, Carmet Division manufactures the complete mining tool, and their reputation depends on Carmet Tools being the finest available. There's a Carmet Bit designed for universal machines and continuous miners of every make, and your Carmet distributor carries a complete line in stock for prompt delivery. Call on him for help with your mining tool problem. ***Allegheny Ludlum Steel Corporation, Carmet Division, Ferndale, Detroit 20, Michigan.***



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1911 • FIFTY YEARS OF SERVICE TO COAL MINING • 1961

Devoted to the Operating, Technical and Business Problems of The Coal-Mining Industry

COAL AGE

JUNE, 1961

IVAN A. GIVEN, EDITOR

Simple and Efficient

ROOM-AND-PILLAR remains the basic mining system in the U. S., with some rare exceptions. And everything indicates that it will continue as the basic system, though perfection of longwall suited to U. S. conditions and development of R-C (remotely controlled) mining units for underground use might see a shift of some magnitude in the future. But room-and-pillar sticks because basically it is a good system for the mining conditions in U. S. It is simple, flexible, easy to understand, and materially eases the problem of roof support in both solid work and pillar recovery.

But is room-and-pillar today the same room-and-pillar of old? A lot of it is, but there have been a few modifications perhaps worthy of note. Bleeders are widely employed, and thus closed panels are now relatively infrequent. "Punch" and contour mining have grown and brought about systems based on frequent openings around the hill. But perhaps the most noteworthy of all the modifications is the "slicing" system, now being increasingly used with continuous miners. In this system a section consists of 4 to 6 places driven up a 1,000 ft or more along the gob and then robbed on the retreat—sometimes with two or more machines. Then another slice is taken. Simplicity and high efficiency are the major advantages.

Crisis Coming?

IS THE UNION-NONUNION STRUGGLE for markets in certain producing areas about to precipitate a major crisis in management-union relations? Perhaps—and perhaps not—but there are signs that an open break could come unless some form of relief from contract conditions is afforded the union operators—or the nonunion tonnage is brought into the fold.

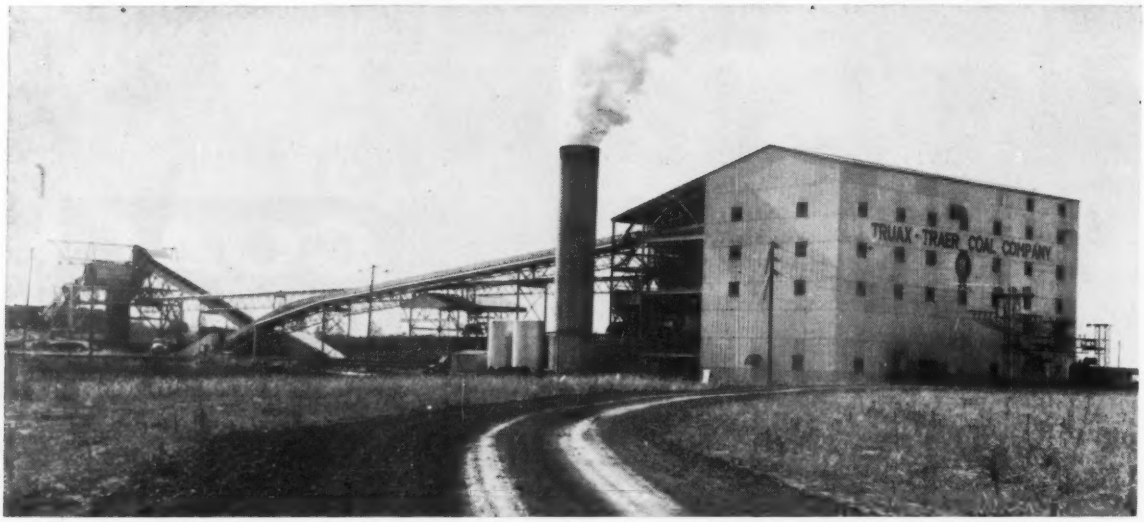
Since the nonunion operators have nothing to gain by signing up, and in fact would lose their present advantage, there is no reason to believe that a new drive by the union would be any more successful than those of the past in such areas as central Pennsylvania, eastern Kentucky, Tennessee and elsewhere. The union operators therefore are faced with the prospect of a continuing disadvantage and further losses of business in the absence of any relief.

What can be done? The answer is not an easy one. But unless it is found, the pressure of nonunion competition will inevitably lead to action of some sort on the part of union producers. Two alternatives are: going out of business or joining the nonunion ranks. One can hope that something can be done so that they will not have to make this hard choice.

Long Overdue

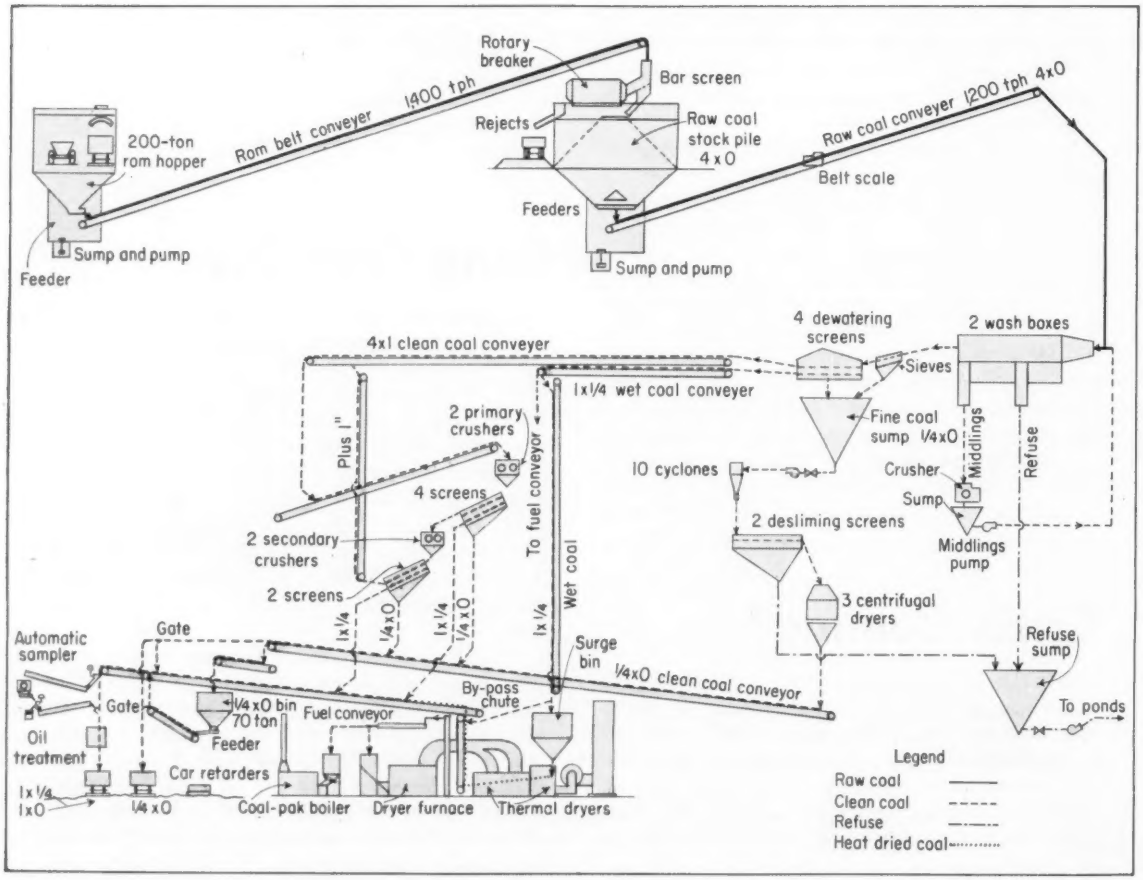
EVERYBODY IS IN IT but coal in the U. S.—such might be a thumbnail summary of diesel progress in underground mining. So far, in coal in the U. S., the diesel has only gotten as far as the conversational stage—and then only for mainline service. Abroad, diesel locomotives have been used at the face for many years, and many coal men abroad consider this their best application. And here in the U. S., the diesel shuttle car is finding increased application in metal and nonmetallic mines. Such an application, and its safety and operating advantages —is the subject of a feature article elsewhere in this issue.

The diesel is no cureall, and presents some problems and hazards of its own. But even if limited to mainline service its advantages—safety and otherwise—more than offset the disadvantages. Not only are the fire and electrocution hazards of the open overhead eliminated, but use of the diesel would remove one of the big deterrents to AC operation, which is inherently safer than DC. Once again it can only be said that removal of the bar to the use of the diesel underground in the country's coal mines is long overdue.

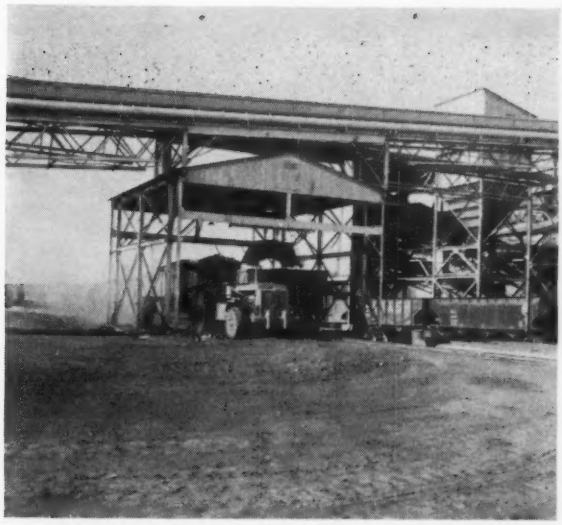


WHITE PLUME issuing from Burning Star preparation plant indicates two-fold efficiency—lower shipping costs as moisture is vaporized and maximum coal yield as solids are trapped in collectors. The plant is Truax-Traer's newest.

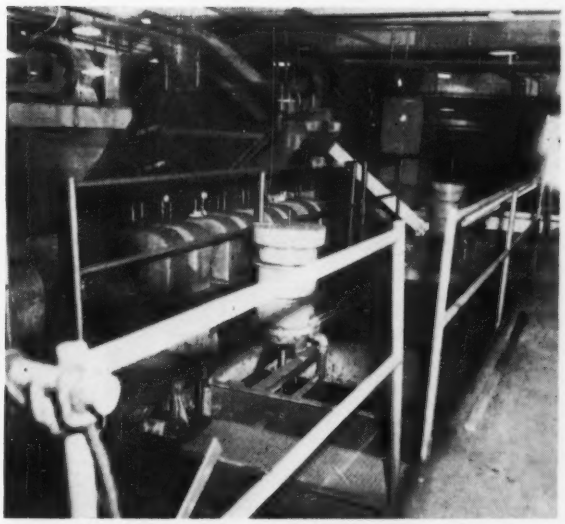
Truax-Traer Off to Fresh Start in



PREPARATION-PLANT TRANSPORTATION is 100% belt conveyorized.



HAULAGE TRUCKS or railroad cars discharge raw coal to underground hopper to begin preparation cycle.



TWO HIGH-CAPACITY WASHBOXES receive 1,200 tph of 4x0 feed. A middlings product is crushed and recirculated.

Southern Illinois

High-capacity stripping and loading shovels operating on 6.9-KV power, quality preparation in a plant equipped for 100% belt-conveyor transportation, and up-to-date practices in overburden preparation highlight Burning Star No. 2 mine.

A NEW FACILITY for continued production of Burning Star coal is Truax-Traer Coal Co.'s latest landmark in southern Illinois. Burning Star No. 2 mine, near Pinckneyville in Perry County, is the company's new spic-and-span property, which includes an efficient 1,200-tph cleaning plant and a strip-mining project of major proportions.

The advantage to Truax-Traer is more-efficient operation. The advantage to the consumer of Burning Star's product is consistently high quality at a stable price. The plant is favorably situated to place coal at the Mississippi River docks at Alton and Ford, Ill., thus supporting T-T's marketing activities along the U.S. inland waterways.

The new plant supersedes the cleaning facilities formerly maintained at the original Burning Star mine near Elkville, Ill. Mining of the No. 6 seam continues at the Elkville location, providing approximately 7,500 tpd to be cleaned on the second shift at the new plant. The coal is shipped by rail from Elkville and cleaned in transit. Approximately 7,500 tpd is loaded in the pits at the new property and cleaned on the first shift. Clean coal output for two-shift washing averages 13,000 tpd, virtually all of it in the 1x¼ and ¼x0 sizes. These dovetailed operations permit highly-efficient cleaning of the Elkville coal as those deposits are worked out, while permitting planned development of full production at the new mine without wasting cleaning capacity in the new plant.

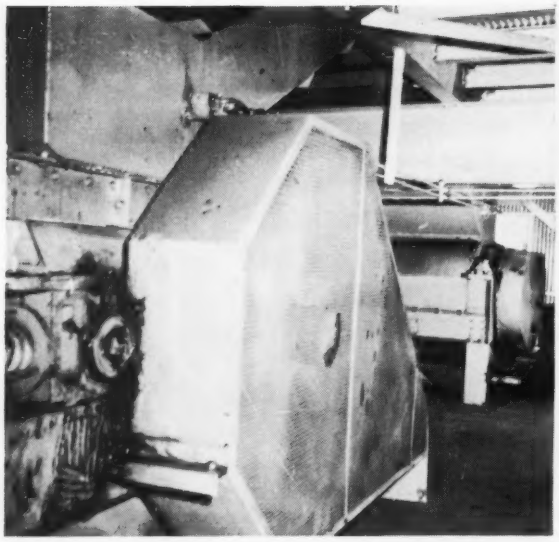
One of the most important projects at the new mine, Burning Star No. 2, is the erection of "The Big Dipper," a Marion 5761 shovel swinging a 65-yd dipper. It is this machine which will pace full production at the new mine. Prior to the time the new shovel is placed in operation the mine will be converted from 4,160-V operation to 6,900 V.

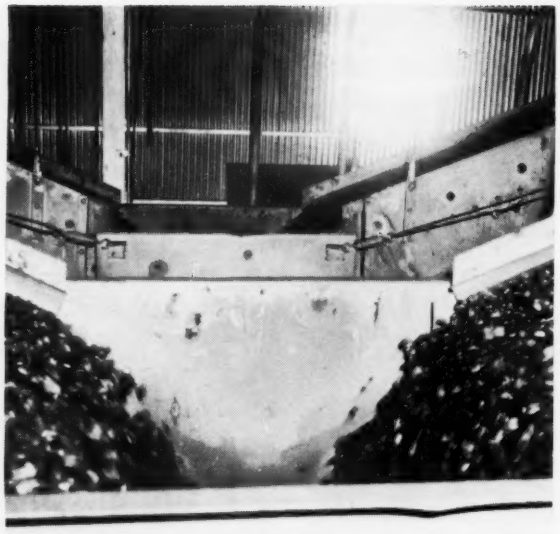
Efficient Preparation

One of the outstanding features of the new plant, designed by McNally-Pittsburg, is 100% belt-conveyor transportation of materials in process, including conveyor lines to and from a 12x27-ft rotary-breaker installation and an adjacent raw-coal stockpile. The preparation cycle begins at a 200-ton R-O-M hopper near the plant, into which rail-shipped coal from Elkville or the truck-hauled coal from the local pits is dumped.

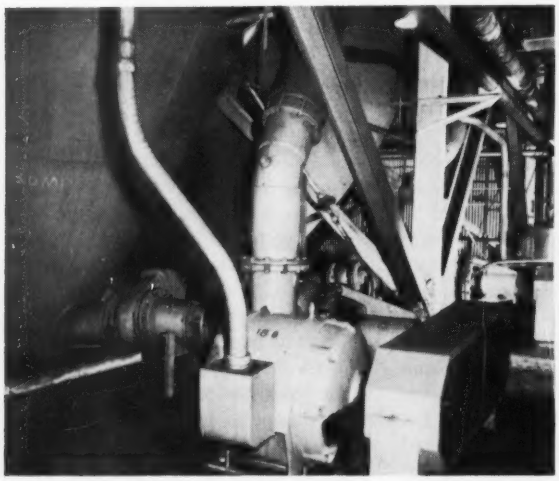
The R-O-M is elevated at a rate of 1,400 tph on a 54-in 7-ply Goodyear belt to a vibrating screen ahead of the rotary breaker. Product of the breaker is 4x0 raw coal, which is chuted into a stockpile that provides storage for 2,500 tons. Feeders beneath the stockpile, controlled by Reeves drives, load the 48-in plant-feed belt with 1,200 tph raw coal. Weight of the raw coal entering the plant is indicated and totalized by a Howe belt scale on this conveyor.

The feed is split to two 7-cell McNally Mogul washboxes which separate clean coal, final refuse and a middlings fraction, which is crushed to minus 1 in and recirculated through the washing step (see flowsheet). A portion of the minus ¼-in is unloaded from the stream of clean coal through a fixed sieve which precedes primary screening. The primary-screening function, sizing and dewatering, is performed on four double-deck, 6x16-

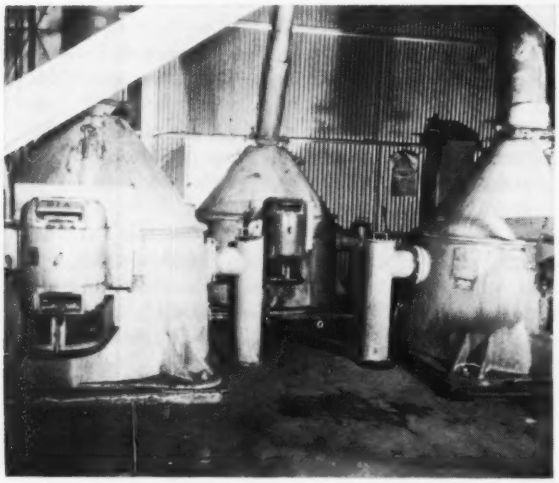




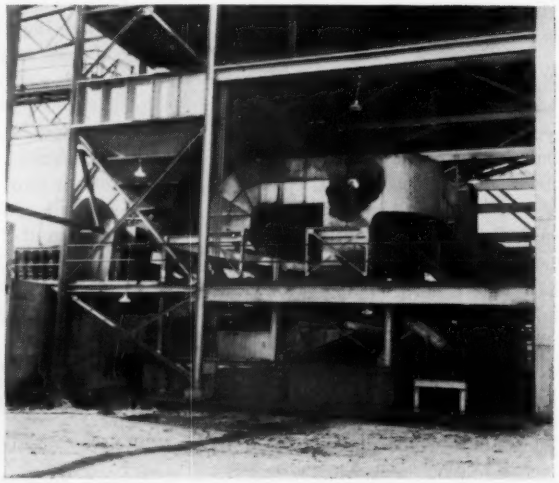
PRIMARY CRUSHERS (left) reduce 4x1-in coal to minus 1 in. Four vibrators remove oversize, fed to secondary crushers.



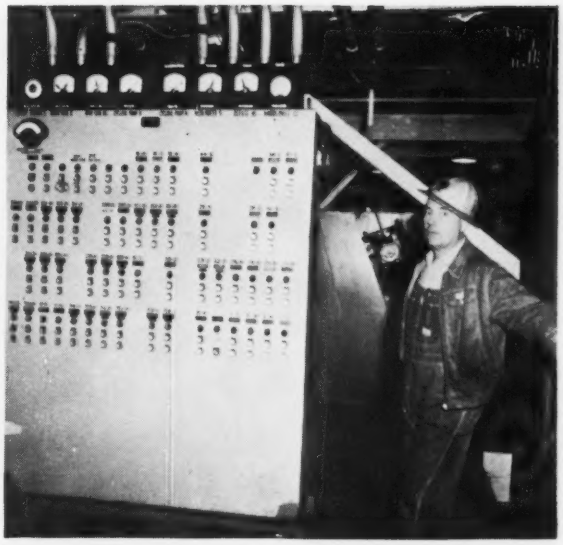
MINUS ¼-IN FINE COAL is pumped from collecting sump (left photo) to a battery of 20-in cyclones for thickening prior to centrifuging at the new Burning Star preparation plant. Cyclones are lined with replaceable rubber inserts.



THREE CENTRIFUGAL DRYERS remove moisture mechanically from 140 tph of the ¼x0 fine coal at Burning Star.

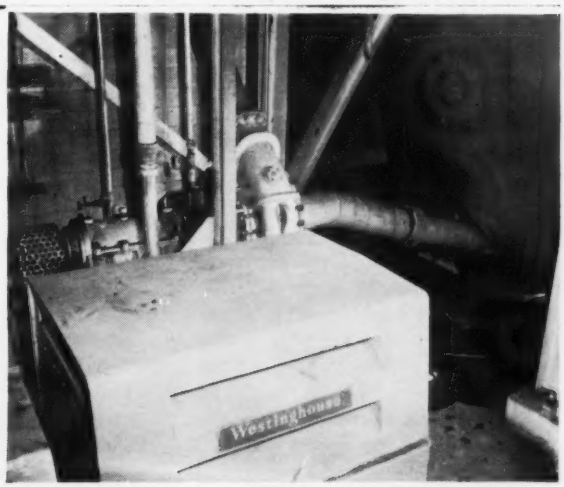


PAIR OF THERMAL DRYERS evaporates moisture from 300 tph of 1x¼-in coal. Fuel used is 12 to 15 tons per shift.



SWITCHGEAR for the entire plant is housed in power center. Centralized controls are installed on operating floor.

FULLY-EQUIPPED laboratory and automatic sampler contribute to consistently high quality. John Gaerig is chemist.



DREDGE PUMP, driven by 300-hp motor, moves refuse to settling ponds. Clarified water is returned to the plant.

ft Allis-Chalmers Low Head vibrators. Overproduct of the top decks is 4x1, which may be loaded if called for but is normally crushed to minus 1 in. Product of the lower decks is 1x¼, which is thermally dried. Underflow of the primary screens is ¼x0—into the fine-coal sump.

When the 4x1 is to be crushed—the normal case, as mentioned—it is brought back from the loading station to the main preparation building, via belt conveyor, to a pair of 36x60-in McNally crushers. Product of the crushers is immediately sized on four double-deck 5x14-ft Allis-Chalmers Ripl-Flo screens. Plus 1-in coal from these screens is fed to a pair of 24x48-in secondary crushers, and the crusher product is finally screened on two double-deck 6x16-ft Ripl-Flos. Oversize from these final screens is recirculated throrgh the primary and secondary crushing circuits. The final result is clean coal of consistently-uniform size. The 10 vibrators in the primary screening and crushing circuits are fitted with 1-in-opening jackets on the top decks and slotted screens, ¼x2^{1}⁄$_{16}$-in slots, on the lower decks.

Turning to the fine-coal circuit, the ¼x0 is pumped from the fine-coal sump to a battery of 10 Krebs D-20 cyclones, which thicken 140 tph of feed for the centrifugal dryers. Underflow of the cyclones is first deslimed on a pair of 4x16-ft single-deck Low Head vibrators (¾ in by ½ mm Wedgewire). Overproduct of the vibrators is fed to three C-M-I EB-36 centrifugal machines. The finished ¼x0 from the centrifugals is stored in a 70-ton bin above the loading tracks.

Overflow of the cyclones, containing 3% solids, is returned to the freshwater tank. A feature of the cyclone installation is the use of replaceable rubber liners, which have shown excellent wearability in this application. Final refuse from the washboxes and from the desliming screens is gathered in a sump and pumped to settling ponds by a 10x12-in Morris dredge pump. Driving power for the pump is supplied by a 300-hp Westinghouse motor.

Thermal drying of 300 tph of 1x¼-

STRIPPING SHOVEL with 30-cu yd dipper and heavy-duty overburden drill pace operations at one pit which is 6,400 ft long. The Illinois No. 6 coal is recovered.

SLURRY-TYPE AGENT in plastic sleeves is used in holes that may block.

DRAGLINE with 25-yd bucket is main stripping unit at second pit. Burning Star No. 2 is projected for at least 20 yr of high capacity production.

ONE-WAY TRAVEL marks haulage operations. Access and exit ramps serve the coal-loading site and help smooth out the Burning Star haulage setup.

n coal is accomplished in two McNally-Vissac dryers receiving hot drying gases from a common furnace. Feed for the dryers comes from a pair of 50-ton surge bins into which the wet-coal conveyor discharges. The product of the heat dryers is mixed on the cross-conveyor to the loading tracks with the 1x¼-in product o fthe crushing circuit, the latter having been sufficiently dewatered as 4x1-in coal in the primary screening step. Note that the arrangement of gates and subsidiary conveyors at the loading plant provides maximum flexibility in loading the desired sizes in the cars.

Strict quality control is an important function at the Burning Star preparation plant. Maximum efficiency is achieved through the use of a McNally-Pittsburg automatic sampler which takes a full cut of the clean-coal stream every 4 min. Samples are automatically crushed and reduced in volume for rapid analysis in a well-equipped laboratory on the ground floor of the main building. Oil-treatment of clean coal is offered, when specified, through a Viking system.

Other mechanical aids further increase overall efficiency, including a Sanford-Day car retarder and U. S. Switch & Signal trackside "squeezers." Remote operation of these units from the loading platform and scale house, respectively, greatly increase safety in the yards in addition to raising efficiency. Rounding out the designs are centralized switchgear and controls.

The entire preparation operation is

HARD LAYER high up in the wall makes a deck charge necessary in some areas. Special boosters are used as primers.

NEW LOADING SHOVEL swings a 14-cu yd coal-loading dipper, reportedly the largest now in use for coal loading.

manned by nine men on the first shift, 13 men on the second shift (the extra men handling the cars from Elkville), and eight maintenance men on the third shift.

Fuel for the drying furnace and for a Coal-Pak installation which supplies space heat in the plant is taken from the 1x¼ wet-coal conveyor. The dryer furnace requires approximately 15 tons per shift. Makeup water is brought into the plant through a 10-in pipeline carried on the gallery of the plant-feed conveyor. Much of this process water is reclaimed from the refuse settling ponds as the clarified overflow of the dams.

Open-Pit Mining

High-capacity machines for drilling, stripping, loading and hauling are a standout feature of operations at Burning Star No. 2. As previously mentioned, Truax-Traer soon will begin to operate a Marion 5761 shovel in the stripping phase. A new loading shovel is equipped with a 14-cu yd dipper, reportedly the largest now in use for coal loading. The Euclid 36-LDT haulage units transport 67-ton loads from the pits to the plant. Overburden drilling is done by Bucyrus-Erie 50-R drills.

The present stripping machines are a Bucyrus-Erie 950-B shovel with a 30-cu yd dipper and an 1150-B dragline with a 25-cu yd bucket. The two mining sites at the new property are designated as Pits 6 and 7. Pit 6, worked by the 1150-B, is 2,400 ft long, and Pit 7, worked by the 950 shovel, is 6,400 ft long.

The Illinois No. 6 seam ranges from 60 to 66 in in the area. It is overlain by hard strata, which varies from 36 to 57 ft in depth, and surface material up to 16 ft thick. Standard operating procedure is to remove the surface material to provide a bench for the overburden drills at the top of the harder measures. In some sections a hard caprock about 7 ft thick exists approximately 25 ft above the coal.

Overburden drills are equipped to sink 10⅝-in blastholes 24 ft apart and taking a 21-ft burden. Monsanto ammonium nitrate is mixed with fuel oil (½ gal per 50 lb) at the hole and charges are detonated through Primacord and Atlas Super G primers. Where the caprock occurs the charge consists of 400 lb at the bottom of the hole to insure good breakage at the toe, and a deck charge of 150 lb at the caprock.

In some instances the blastholes tend to close up somewhat before the charges can be placed. In these situations Hercules Flogel, a plastic-encased slurry, is used. First, a 4-in pipe is forced through the blocked portion of the hole, then the 3-in 10-lb units of Flogel are placed through the pipe. The Flogel is less sensitive than the conventional mixtures. Its detonation velocity is approximately 19,000 fps. The product appears in one of the accompanying illustrations.

The dragline in Pit 6 attacks the broken overburden by opening a keyway at one end of the property to the full width of the cut, which is from 90 to 120 ft. The shovel in Pit 7 operates on the solid coal, taking a 60-ft cut.

One of the newer units at the mine is the Marion 181-M loading shovel in Pit 7, a 320-ton machine with a total of 1,000 hp in its drive motors. The machine was specially designed to permit the change from 4,160-V power to 6,900 V with a minimum of modification. The dipper holds 14 cu yd, as mentioned. Haulage units do not turn in the pit. Access and exit ramps are provided to smooth out the haulage function. A shotfiring team using a motorized coal drill precedes the loading shovel to break the coal.

The Burning Star No. 2 operation employs 128 men, including the 30 men on three shifts at the preparation plant, and 11 supervisors.

Truax-Traer operations are headed by H. C. Livingston, president, and H. M. Tibbs, vice president, at the Chicago headquarters of the company. R. E. Henderson, general manager, and C. D. Heatherly, assistant general manager, are in charge of field operations. The mine staff is headed by H. M. Clark, mine superintendent. John E. Robinson is plant foreman, Harry Singer is master mechanic and Yutaka Hattori is chief electrician. Pit foremen are Charles Morgenthaler and Fred Degler. The office force is headed by Neil Rice, supply clerk, assisted by Lee Rice.

FIRST DIESEL SHUTTLE CAR put in service at TCI was a diesel-electric unit. A two-cycle direct-injection 82-hp engine drives a 50-kw generator.

SECOND STEP in dieselization was addition of full diesel-powered car with four-wheel drive and steer. Unit has four-cycle engine.

Experience With Underground Diesels

Diesel-powered shuttle cars and loaders reduce hazards while adding flexibility to mining operations at TCI's underground iron ore and limestone mines.

Engineering and Operating Staff
Ore Mines and Quarry
Tennessee Coal & Iron Div.
U. S. Steel Corp., Fairfield, Ala.

HAZARD REDUCTION is one of the major benefits of the use of diesel-powered equipment in the underground iron ore and limestone mines of the Tennessee Coal Iron Division, United States Steel Corp. Diesel-powered shuttle cars, for example, have no trailing cables, which our records show to be responsible for a number of accidents, including tripping, flipping rocks and other objects, electrical shock, fires and several others.

And trailing cables are always subject to abuse from sudden strain and from being run over, resulting in failures which cause delays and replacements.

Do diesels bring in other hazards, such as fumes? Fumes can be produced as a result of faulty scrubber maintenance, but they are readily detected and thus are self-policing.

On the production side, dieselization is changing our mining picture rather dramatically. Proper recognition must be given to the problems of diesel equipment, but we find the advantages far outweigh the disadvantages. It is difficult to measure all of the benefits we have derived from the use of diesel equipment in our underground mining operations, but they are a major factor in obtaining increased tonnages at a lower cost with increased safety in our ore mines. The increased flexibility of shuttle-car operation has enabled us to change mining layouts wherein less service work for the operation would be required.

Applying and integrating diesel equipment into all our mining operations will provide a greater field for the application of production engineering to the improvement of mining methods and costs of the future.

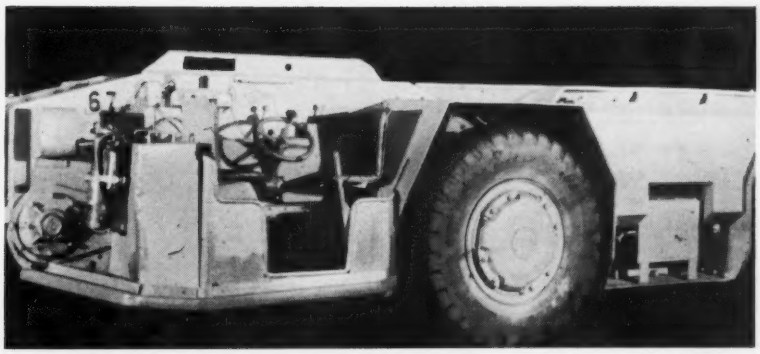
Diesel Experience

Our experience with diesel shuttle cars began in June, 1951, when three diesel-electric shuttle cars were purchased for use in our underground mine. There the ventilation was more than adequate for the operation of the diesel engines. These three cars, which are still in service, have two-cycle 82-hp direct-injection engines powering 50-kw generators. The cars were designed in accordance with the Bureau of Mines Schedule 24 for diesels in noncoal mines and represented a major step in the development of underground rubber-tired vehicles. The major advantage of this type of car is its self-contained power plant.

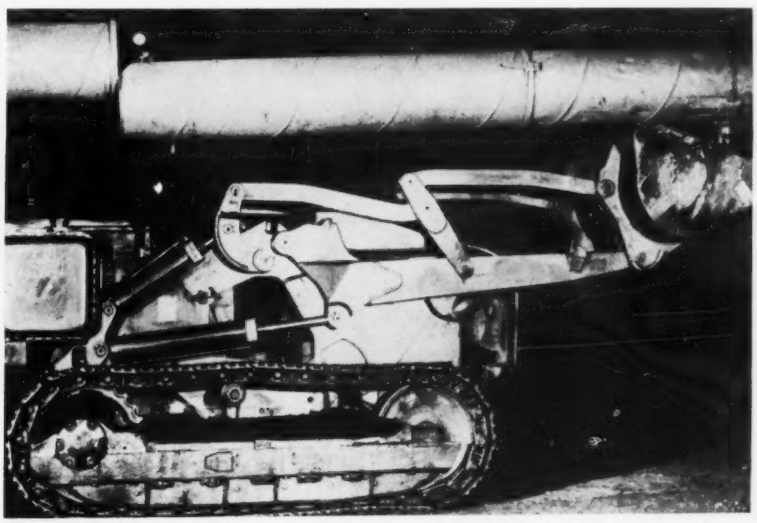
The limitations and problems associated with a cable reel were eliminated, including length of run and route of travel. Capacity is about 13 tons and the car can attain speeds of about 3 mph on grades up to 8%.

The exhaust conditioning is accomplished with a scrubber. It washes the exhaust gas in a 10% aqueous solution of sodium sulfite inhibited by

A similar report was presented by Peter J. Zukow, superintendent, Mines 7 and 8, Ore Mines and Quarry, at the American Mining Congress, May, 1961.



THIRD TYPE of car is also a full diesel-powered unit with four-wheel drive and steer. It carries a slightly larger payload.



DIESEL-POWERED FRONT-END LOADER helps extend 18-in steel ventilation tubing in working place. Auxiliary fan blows 6,000 cfm of air through tubing.

the addition of 0.5% hydroquinone. And it effectively removes the ethelaldehyde and formaldehyde gases from the engine exhaust. The presence of these aldehydes in the exhaust is known to be responsible for the disagreeable odor, and the nose and eye irritations that accompany the use of diesel engines.

When the success of diesel equipment became apparent, plans were formulated for more underground units. Experience with the three diesel-electric shuttle cars enabled us to determine what type of equipment would be needed in the future. These diesel-electric units were two-wheel drive and two-wheel steer. Operating experience indicated that the cars should be completely diesel, and should have four-wheel drive and steering.

The electric-cable reel shuttle cars were replaced, as required, with improved and completely dieselized units. The new cars were equipped with non-chemical-type exhaust-gas conditioners using only clean water.

Two diesel shuttle cars from one manufacturer were placed in operation in 1957; six diesel cars from another manufacturer were placed in operation in 1958, and five additional cars were purchased in 1959. We now have a total of 3 diesel-electric and 13 completely diesel shuttle cars in operation.

The completely diesel shuttle cars had to meet these specifications:

1. The car should be able to operate on grades up to 25% at speeds up to 4 mph, with a speed of 1.5 mph tolerated on the heaviest grades.

2. The engine must have the U. S. Bureau of Mines approval plate. The exhaust scrubber should have a minimum operating capacity for 8 hr of operation.

3. The engine should be four cycle with indirect fuel injection.

4. The car should have four-wheel steer and four-wheel drive. It should be able to negotiate a 90-deg turn in an 18-ft opening without maneuvering.

5. Capacity should be about 230 cu ft.

Training Operators

With the increase in the number of diesel shuttle cars in operation, an intensive operator training program was started to attain maximum safety and efficiency. Safe practice instruction cards were prepared and used to train the operators in safe and correct operating procedures. Safety within our mining operations is of prime importance, and the prevention of personal injuries must continue to be the first consideration.

Diesel Front-End Loaders

After several years of conventional mechanized mining followed by the introduction of the diesel-electric and diesel shuttle cars, local management sought ways to increase loading capacity. Studies of the mining operation showed that the loader spent much of its time loading the scattered material resulting from blasting. The problem was to find a means of concentrating this loose rock and loading it quickly.

The solution was found in a diesel front-end loader, which took care of the scattered rock problem, and proved advantageous for utility work. Two diesel front-end loaders were purchased in 1956 and lived up to expectations. In 1957, 10 additional machines were purchased, making our mines diesel-equipped in all operating sections.

We have been willing to try new and unfamiliar techniques and equipment in a continuing effort to increase the safety of our mining operation and further reduce the cost of mining. For future new mines serious consideration will be given more dieselization with the application of diesel locomotives, drill jumbos and service equipment.

There is no doubt that continued study and engineering will develop even better diesel mining equipment and mining methods than are in use today. The use of diesel equipment

DAILY SERVICE CARD FOR DIESEL SHUTTLE CAR

Service	Action
1. Make-up Tank	Do not operate when dry.
2. Scrubber Tank	Drain and flush with water (each shift).
3. Brakes (before moving car)	Fill make-up chamber with brake fluid and check pedal.
4. Fuel tank	Diesel fuel (No. 1).
5. Exhaust system	Check for leaks.
6. Hydraulic system	U R S A - 30.
7. Crankcase	U R S A - 30.
8. Oil Bath Filter (each shift)	Clean with diesel fuel and fill with U R S A - 30.
9. Engine transmission	U R S A - 30.
10. Intermediate conv. transmission	Sil-X (check each shift).
11. Main transmission	U R S A - 30.
12. Radiator	Fill before starting engine.
13. Lights	Report any not operating properly.
14. Fire extinguisher	Report if damaged or missing.
15. General condition	Report leaks and loose parts.
16. Fuel Injection Pump & Governor	Fill to petcock level in both cases.

DAILY SERVICE CARD lists items for operators to check before, during and after operating a diesel shuttle car.

MAINTENANCE CHECK SHEET
UNDERGROUND DIESEL ENGINES
EACH SHIFT

LOCATION: _____ DATE: _____
CAR NO.: _____ A. M. _____
P. M. _____

	REMARKS
CLEAN AND CHARGE SCRUBBER	
CLEAN - OIL BATH AIR FILTER	
PRIMARY FUEL FILTER	
LUBRICATING OIL	
FUEL OIL	
COOLING WATER	
FIRE EXTINGUISHER	
CHECK ENGINE FOR READINESS	
TACHOMETER READING	
MINIMUM IDLING SPEED 900 RPM	

TOTAL HOURS _____

CHECKED BY: _____

CHECK SHEET is filled in during each operating shift after inspecting diesel.

TENNESSEE COAL AND IRON
Division
UNITED STATES STEEL CORPORATION
Ore Mines and Quarry

To: Chief Engineer Date:
From: Ventilation Engineer
Subject: Exhaust Gas Analysis—Diesel Equipment Underground

Below are the readings taken on diesel equipment underground during the week of _____ to _____, 1961.

Equipment	Location	% CO	% CO_2	% O_2	NO_2 (ppm)	Remarks
3 Shuttle Cars & 1 FE Ldr.	14 Panel #7 Mine	0.00	0.00	20.6	0.00	In return air course
1 Shuttle Car & 1 FE Ldr.	So. Hlg. #7 Mine	0.00	0.00	20.6	0.00	"
1 FE Ldr.	20 Panel #7 Mine	0.00	0.00	20.6	0.00	"
2 Shuttle Cars & 1 FE Ldr.	35 Panel #8 Mine	0.00	0.00	20.6	0.00	"
2 Shuttle Cars & 1 FE Ldr.	SE Hlg. #8 Mine	0.00	0.00	20.6	0.00	"
2 Shuttle Cars & 1 FE Ldr.	132 Panel #11 Mine	0.00	0.00	20.7	0.00	"
2 Shuttle Cars	123 Panel #11 Mine	0.00	0.00	20.6	0.00	"
2 Shuttle Cars & 1 FE Ldr.	119 Panel #11 Mine	0.00	0.00	20.6	0.00	"

Exhaust gases on the diesel equipment were well within the required limits and oxygen content above standard requirements.

Allowable Concentration	% CO	% CO_2	NO_2 (ppm)	Remarks
Oxygen content to be not less than 20%	0.01	0.50	25	Gases in general atmosphere after scrubber

Copy to: General Superintendent
Operating Superintendent
Chief Mine Inspector
Maintenance Superintendent
State of Alabama

_____
Ventilation Engineer

MAINTENANCE CHECK SHEET
UNDERGROUND DIESEL ENGINES

LOCATION: _____ DATE: _____ 19__
CAR NO.: _____ TACHOMETER TOTAL HRS.: _____

100 HRS.		REMARKS
FAN AND GENERATOR BELTS		
CHANGE LUB OIL		
CHANGE LUB OIL FILTER		
AIR CLEANER		
THROTTLE CONTROL MECHANISM		
BATTERY WATER		
BATTERY CHARGING GENERATOR		
POWER GENERATOR		
OVER SPEED DEVICE		
300 HRS.		
BATTERY CHARGE GEN. LUB.		
STARTING MOTOR LUB.		
PRIMARY FUEL FILTER		
SECONDARY FUEL FILTER		
ENGINE TURN UP		
1000 HRS.		
FULL TANK		
CYLINDERS AND AIR BOX		
BLOWER		
COOLING SYSTEM		
OIL COOLER		
FAN BEARINGS		
FLUID LINES		
POWER GENERATOR BEARINGS		
REPLACE SCRUBBER GASKETS		
3000 HRS.		

CHECKED BY _____

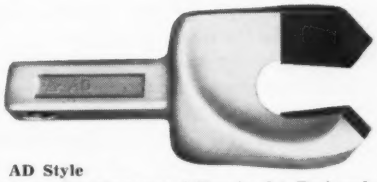
ADDITIONAL CHECKS are made at 100, 300 and 1,000 hr for diesel shuttle cars. Bulldozers and front-end loaders are checked at 20, 60, 120, 240, 480 hr.

REGULAR CHECKS of all diesel engines are made by the ventilation department. Weekly tests for CO are made of exhaust gas.

Metallurgical Memo from General Electric

Bit illustrated: CCS-3

We could lower our quality... but BIT COST PER TON WOULD BE GREATER



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Auger Bit (Square and Hex shank). Designed for top performance under even the most severe cutting conditions.

CC-12 Style
Enclosed Tip Machine Bit For New Style Block. The carbide tips are enclosed in steel, resist breakout or tip loss. Also available with on-top tip.

A "cheap" bit is no guarantee of total mining economy — in fact, it's the most expensive way to operate!

We could make "bargain basement" mining bits by lowering our quality. Then we could only promise you lower output per bit, reduced production, unpredictable tool life, more downtime, higher over-all costs. WE WON'T DO IT!

We purposely build uniform quality into every Carboloy mining bit . . . we make the tips extra long . . . we provide a stronger braze. Why? To keep your machines producing longer, more dependably, AND AT LOWER COST!

Your local Authorized Carboloy Mining Tool Distributor and our local engineer are equipped to give you all the facts and assistance you need. Or write: *Metallurgical Products Department of General Electric Company, 11120 E. 8 Mile Ave., Detroit 32, Michigan.*

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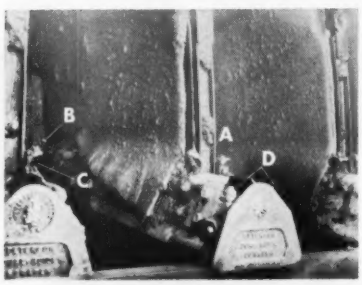
INCREASE

Wire Cloth

FILTER EFFICIENCY

Peterson's "Dual Guide"* scrapers discharge close to 100% of the filter cake (even with thin cakes) without tearing wire cloth. You gain a longer life for your wire cloth, a dryer cake, and up to 20% increase in the equivalent effective filter area! This means INCREASED FILTER EFFICIENCY.



Here are the reasons for these outstanding advantages. Guide surfaces are provided on the rim (A) and the heel (B) of the disc, aligning with the dual guides on the scrapers. These guides combined with the pin or hinge mounting in the rear of the scrapers (C) and the bar hinge in the front (D) allow the scrapers to follow any misalignment of the disc. Thus, a close, positive parallel setting is maintained at all times. Get the complete story on the "Dual Guide" Scrapers and the savings they can effect in your plant. Your present filter can be converted, or they are standard equipment on all Peterson Wire Cloth Filters. Write for Bulletin NO. D. G. - 104.

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Look for the sign of the Viking Mark Parts

PETERSON FILTERS
AND ENGINEERING COMPANY
P. O. BOX 606 • SALT LAKE CITY 10, UTAH

will continue to increase because of its mobility, efficiency and safety in operations.

Maintaining Underground Diesels

Diesel engine maintenance, properly executed, can mean increased equipment availability, lower operating costs and better performance.

Preventive maintenance performed on schedule is the easiest as well as the least-expensive type of maintenance. It requires less work and material to prevent failures than to remedy them. Preventive maintenance is simply a series of checking, replacement and repair operations intended to forestall progressive damage to equipment. The value of the program depends upon meeting proper time requirements by adhering to a well-planned schedule.

Delaying a maintenance job that needs to be done is a reckless gamble. There are very few engine failures which are not preceded by warning signals and signs that can be detected by a good maintenance man.

The diesel engine is constantly giving signs of its condition for the operator or the maintenance man to interpret. In many cases, the equipment operator is the first to detect signs of trouble. Unless he reports it to the maintenance department, the faulty condition may be missed until real trouble develops. It never pays to run an engine until it fails, because failure of one part usually results in ruin of other good parts.

A minimum of paper work is required to control the maintenance program. Check sheets are needed to detail the jobs to be done and to make a record of how and what is done. Summary work orders, listing labor and materials, are important to cost control.

It is important to remember that paper work is useful only as it reduces the work load instead of contributing to it. Paper work needs to be as simple as possible to maintain its effectiveness.

Dirt is the cause of most wear in an engine. Much of it is composed of gritty mineral particles, which are hard enough to penetrate the toughest oil film and grind away metal. Cylinders, piston walls and piston rings suffer most from dirty intake air. They wear hundreds of times faster with dirty intake air than with air filtered by an effective air cleaner.

A worn-out engine is one which has had only an ounce or so of metal worn away from critical bearing or sealing surfaces. Replacement of worn parts and the time lost may cost hundreds of dollars, which could have been saved by keeping out the dirt. The moral: Be sure the air filter is effective.

Fuel must be the type that will burn readily and completely within the engine. We use No. 1 diesel fuel. It must be injected as a fine spray and mixed with clean air to burn. The penalties for violations of these requirements are the same as for using poor-grade fuel.

Proper fuel combustion depends upon adequate air supply as well as adequate fuel supply. When air supply is restricted, the engine will lose horsepower, the exhaust will be smoky and some of the unburned fuel will get by the piston rings and dilute the lubricating oil.

Lubricating oil performs four functions in a diesel engine: reduces friction; scavenges by picking up carbon and other small particles; cools pistons, liners, and bearings; and completes the seal of rings to pistons and cylinder walls. Lubrication failures can be costly. Downtime and overhaul expense for one engine failure may cost as much as 1,000 oil changes.

Engines must not be operated beyond the maximum rated speed for which they were designed. Overspeeding often causes pistons to strike and break valves, and injectors to stick. When a shuttle car, going down grade, pushes the engine above the governed speed, the governor shuts off all fuel to the injectors and deprives them of lubrication.

Weekly analyses are made of the atmosphere around each piece of equipment to determine and control the percentages of carbon monoxide, oxygen, carbon dioxide, nitrogen oxides and aldehydes. If there is any indication that the volumes of gas or fumes are approaching the lower limits of permissibility, that particular piece of equipment is removed from service and corrective measures taken.

All diesel engines are shut off if there is any interruption of underground ventilation for any reason.

Diesel equipment requires more daily maintenance than electric cable reel equipment. But after the operators and maintenance personnel are properly trained, the labor and material costs are not abnormal.

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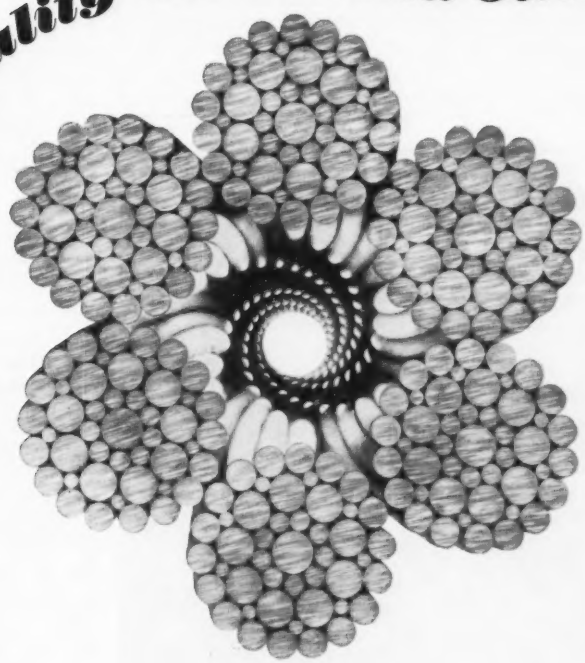

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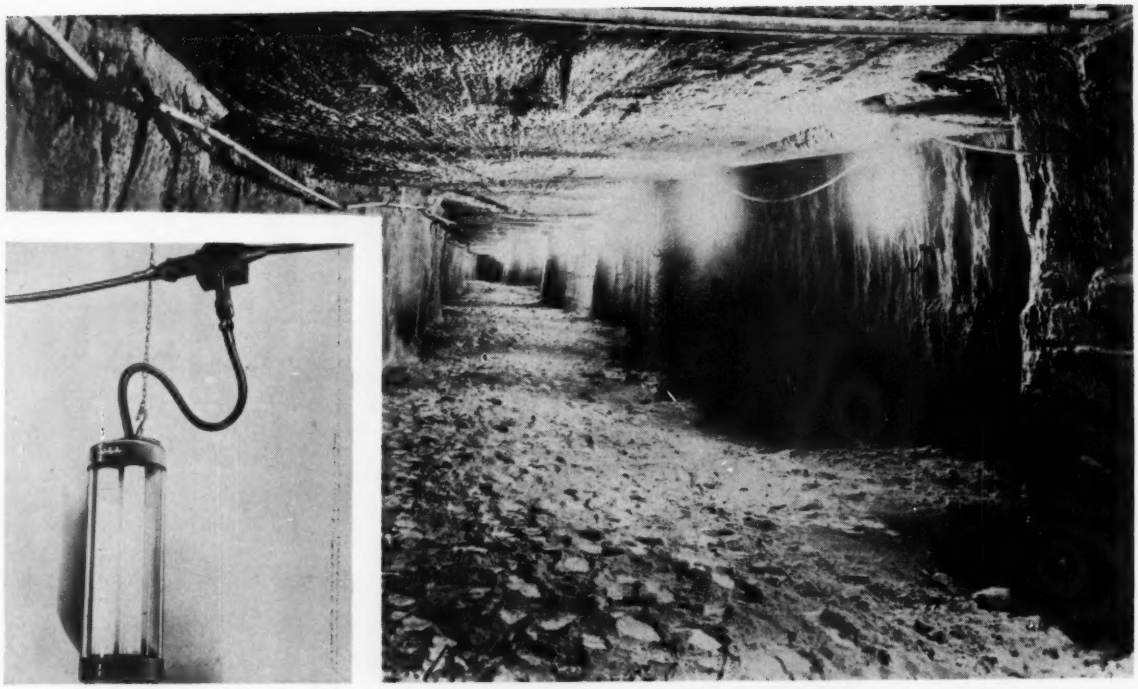
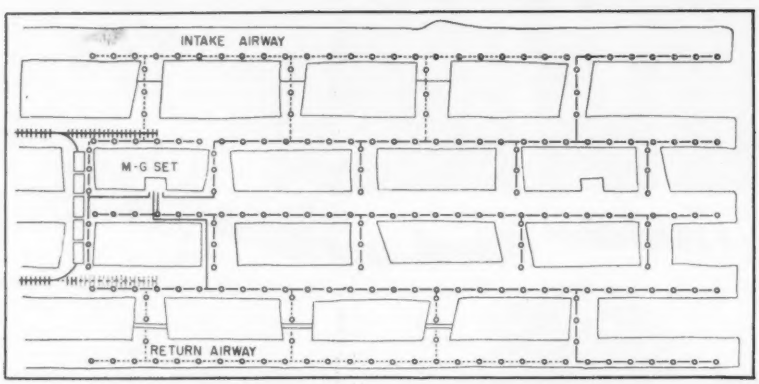
You get a lot of work out of it



WHAT A REALLY LIGHTED PLACE in a coal mine looks like. One type of permissible unit is shown in the inset. Major increases in productivity and safety are achieved.



FACE-LIGHTING LAYOUT employed in an experimental section in the mid-50s, proving the safety and productivity possibilities.

GOOD LIGHTING for nonface areas includes this haulage setup with 3-lamp clusters on the rib providing around 1 foot-candle with minimum contrast between light and dark spots, thus better seeing for the motorman.

Good Lighting . . . What It Means in Coal Mining

Major increases in productivity and safety have resulted from past trials of facilities for face lighting. Equipment now available can provide such lighting at reasonable cost—and can assure similar benefits along haulageways and elsewhere.

FEW COAL MEN have ever actually viewed a working face underground for the simple reason that the illumination provided is not sufficient to enable such a face to be really seen clearly and in its entirety. Only when floodlights are set up for photography, maintenance or the like is a working place ever lit up so that full seeing is possible. The difference is almost literally the difference between day and night.

Contentment with the illumination provided by the usual miner's electric cap lamp improved though it has been, plus any headlights available on the machine, reflects basically lack of realization of the cost effects of illumination on both safety and productivity. Take safety first.

One major manufacturer, as an example, increased the lighting level in its erection shop from 2 foot-candles to 18. Accident frequency was cut 32%. Repainting for better utilization of illumination raised the light level to 23 foot-candles and resulted in a further cut in the accident rate to 42%.

In one of the earliest attempts at lighting up a working section in a coal mine, the lighted section had no accidents in 2 yr, compared to one each for three other sections, two for another section and five for another. Production performance in the lighted section, operated with conventional offtrack equipment, 6-ft coal height, was 25.8 tons of coal and 8 tons of impurities, or 33.8 tons per man-shift, over a period of a year. Productivity in nonlighted sections ranged from 16.0 tons of coal (21.2 tons total, including impurities) to 24.3 tons of coal (28.9 tons total). Total tonnage per man-shift was 17% above that for the next best section.

An increase in productivity of as low as 5% or less is a most worthwhile goal. Say a unit averages 500 tons per shift and charges to the unit total $1,500 per shift (labor, supplies, supervision, depletion, machine cost, overhead, etc.). Raising its output 5%, or 25 tons, as a result of better lighting, would cut the cost of coal from $3 a ton delivered to the main line to, say, $2.90 after allowance for extra supplies, power, maintenance and depreciation of the lighting system, and similar outlays. At two shifts a day, 225 days a year, the total saving becomes $23,025. Cost of such a system still can only be estimated but it is a fair guess that with 4 to 6 working places it would be less than $1,000 per place. In addition to the production increase there also would be a major safety improvement.

Increased productivity and safety reflect increased ability to see. At very low levels of illumination, where a man can barely see, much of his energy is expended in overcoming the difficulty of the seeing operation itself. As a result, his productivity is low and his reserve of energy is small.

Many jobs around coal mines are in the "just barely seeing class." And, of course, if a man has difficulty seeing a hazardous condition he is less likely to avoid or correct it. Mining forces men to work close to machinery in confined quarters and exposes them to the natural hazards of roof and rib falls and the like. Ability to see is paramount in doing something about such hazards.

Need in Coal

With some older-type cap lamps and machine headlights the coal situation is almost, at times, literally "night in the mine." Visibility readings (see accompanying panel for definition) frequently are in the range of 1 to 2, which represents major seeing difficulty. In general it is felt that the satisfactory level in industry is 5.

Tests run some years ago are the basis for concluding that the level of coal-face lighting is low with conventional equipment, as follows:

Loading coal, cap lamp and two headlights — visibility, 1.8 before starting and 1.2 after as a result of dust.

Drilling shothole, cap lamp—visibility of chalk mark on face, 2.1; of drill itself, 1.52.

Cutting coal, cap lamp — visibility, 1.48.

Low visibility in all these instances reflected a combination of low machine brightness, low contrast and low candlepower. To raise visibility to the accepted level of 5, it was calculated that illumination would have to be increased as follows:

Loading coal, 110 times
Drilling, 40 times
Cutting, 35 times

Face Lighting Today

With rare exceptions the sources of light at the working face in a coal mine are two:

1. Cap lamps.
2. Machine headlights.

Cap lamps of the modern type can provide beam-candlepowers of 2,000 plus as a result of the addition of focusing facilities. But the intensity drops off rapidly from the center and thus the lamps are really suitable only for long-range work. If a man's work is primarily at close range, a semimat-reflector normally is better.

Like cap lamps, machine headlights have been materially improved. The incandescent source predominates, and light output can vary widely, depending on voltage, dust and so on. Frequently, machine lights are smashed or knocked off completely, even if dead bulbs are not replaced. Under the worst of con-

Fundamental in Seeing

We see an object when light from it enters the eye in sufficient quantity to produce a visual sensation. The light we see by may be emitted directly from the object (as a light bulb), or it may be reflected from it, as from this page. If too little enters the eye from the object, we cannot see said object. The eye, however, is remarkably adaptive, We can see in sunlight where the intensity is several thousand foot-candles, and we can see after a fashion in moonlight of 1/1000 foot-candle. But we cannot see nearly as well.

Seeing Factors

Size of the Object—The larger the object the easier it is to see, but we can't do much about changing the size of a cutter bit, for example, or a roof-bolt nut. So we have to take size as it comes.

Time for Seeing—It takes time to see. Often objects or details not visible at a quick glance show up when we take time to look.

Brightness of the Object—The more the light falling on an object the brighter it becomes and, in turn, the more light it reflects to our eyes. Also the higher the reflectance, or reflection factor, of an object the brighter it appears.

Brightness Contrast of the Object—This is the difference in brightness of the object and its background divided by the background brightness. The result is expressed in percent. One of the difficulties in coal-mine lighting is the lack of brightness contrast, in part a result of the fact that coal soaks up about 85% of the light that falls on it.

Definitions

Candlepower—The luminous intensity of the flame of an ordinary vertical candle about 1 in in diameter.

Foot-Candle—The level of illumination on a surface 1 ft from a 1-candlepower light source. Commonly obtained by using a light meter.

Foot-Lambert—Average brightness of any surface, or the uniform brightness of a perfectly diffusing surface, emitting or reflecting one lumen per square foot. Daytime sky brightnesses go up to 2,000 foot-lamberts or more; the printing on a newspaper under an ordinary home lamp is about 10; at the face in a coal mine, 0.01 to 0.05. Commonly obtained with a brightness meter.

Lumen—The light emitted from a one-candlepower source in a unit of one solid angle (steradian). Total lumens from a 1-cp source is 4 π, or 12.57.

Visibility—With normal vision we are close to the point of being unable to see when scanning a copy of the *Reader's Digest* outdoors in the light of a full moon. If there were two full moons the visibility rating would be 1. Therefore readings of 1 or 2 (using a visibility meter) represent difficult seeing tasks. Most authorities agree that an average level of 5 is satisfactory in industry.

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ditions, therefore, the only illumination becomes the operator's cap lamp. This is a frequently found condition, and it has a definite effect on safety and productivity.

Even though the illumination level still is low a great deal can be done to keep it to the maximum and thus achieve a measurable improvement in the face situation. Among the steps are:

1. Insuring that machine headlights are always in operation, which involves prompt troubleshooting if a light is lost for any reason.
2. Good voltage.
3. Clean fixtures and lenses. Only a little dust severely cuts light output.
4. Good dust-allaying practices. Even the best of headlights — and even powerful photographic floodlights — will not permit seeing where dust concentrations are heavy, particularly if the man is behind the lights, which usually is the situation. Anything within reason that can be done to eliminate or knock down dust will help with face lighting as well as general safety.
5. Lightening roof, ribs and floor. This may be and usually is a difficult problem, particularly in the face mine. But it does provide another reason for following the face as closely as possible with rock dust. The miner operator may benefit little or not at all but shuttle-car operators and all who work behind the unit will receive considerable help.
6. Keeping equipment painted with a product that heightens its visibility.

Travelway and Special-Area Lighting—Where special areas, such as shuttle car-to-belt or other transfers are on fresh air the problem becomes the relatively simple one of installing the proper number of the right type of fixtures so that the men who must be around and use the facilities will have an average illumination level of 5 foot-candles or more—with a minimum of glare.

Between fresh-air points and the face permissible equipment is required, and it is in this area and at the face that the biggest problems exist. Some suggestions for solving them are summarized in the following discussion.

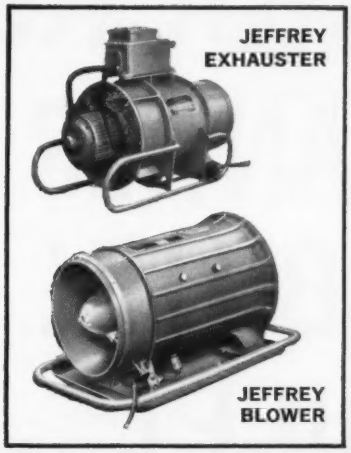
Face Lighting Tomorrow

The cap lamp and the machine headlight, improved as a result of continuing research and engineering, will still be necessary and will contribute to the final solution of the face-lighting problem. The main reliance, however, if logic and the results of past experiments govern, will be on some such system as the following: permissible fluorescent fixtures with AC power.

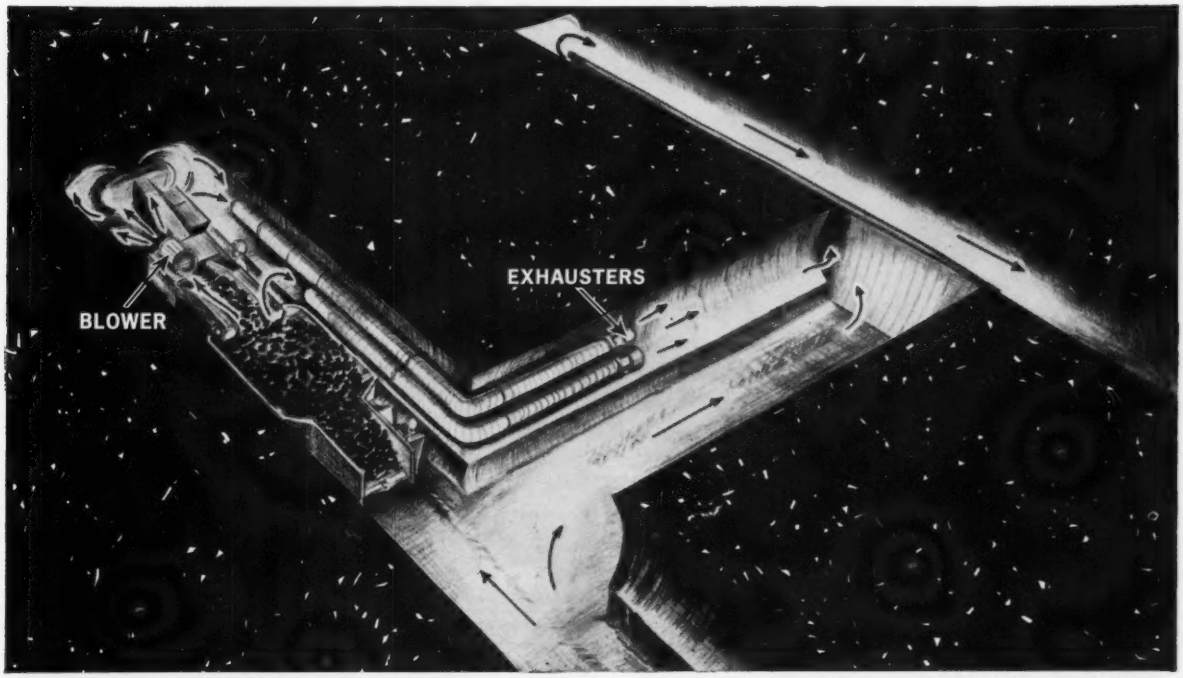
The fluorescent tube requires AC, which is becoming more and more available as the industry increases its use. Even without AC as the primary power, current for fluorescent equipment can be supplied—as it has been in experimental installations — by DC-AC m-g sets. Inverters are another possibility.

One big advantage of the fluorescent tube is the fact that in the "instant-start" type it can be broken without igniting gas and dust, and thus need not be enclosed in an explosionproof housing. That is a major disadvantage of the incandescent lamp, which also has the further disadvantage that one is blinded momentarily when one looks at the source. This was a major reason why success was not attained in the first full-scale test of face lighting conducted at an Illinois mine in the 30s. At that time, only incandescent lamps were available.

With AC and fluorescent tubes available, other elements are a per-



Here's how to use Jeffrey Auxiliary Fans to reduce explosion hazards



Jeffrey cooperated with mining engineers to design this ventilation system, now proved out by the U. S. Bureau of Mines.

When you force fresh air across the working face, you dilute any gas being liberated and move out dust—so the exhaust system can more easily clear the atmosphere. Explosion hazards are reduced, visibility is improved—increasing the miners' efficiency.

A Jeffrey Blower mounted on the mining machine blows fresh air forcefully against the working face, diluting and moving out methane to the suction duct. The Jeffrey Exhauster pulls gas and dust-laden air out of the work area through the tubing and discharges it out into the return air course, keeping the atmosphere clear.

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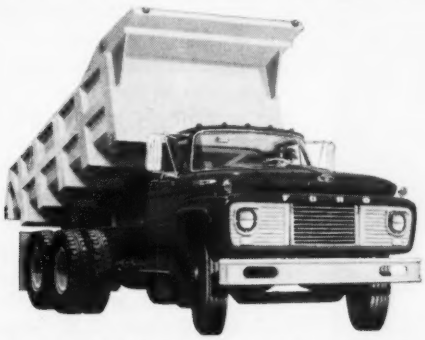

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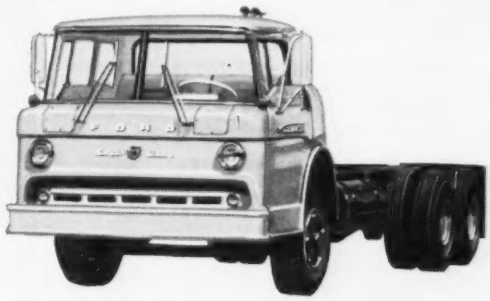

Tandem Axle models are available with tilt cabs. As with conventional tandems, aluminum walking beams, wheels and fuel tanks are offered to cut weight . . . increase payload capacity.

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missible fixture and power-distribution system. These now can be obtained, and more, meeting the requirements of USBM Schedule 29, which became effective Jan. 10, 1956, will be offered in the future. Thus, the components of an approved and proven-effective face and face-section lighting installation include the following:

An AC source — DC-AC m-g set, inverter or transformer — supplying nominal 115-V current. The future may bring high-frequency circuits—400 cycles or more—for lamp service.

A cable system with connectors that may be made and broken at will —and that are designed for frequent making and breaking, perhaps daily.

A permissible fixture that is light but sturdy and easy to move and hang on spads driven in the rib.

A fluorescent-tube light source — "instant-start" type.

Except for inverters and high-frequency AC sources, all these elements are, as noted, now available. The thinking to date envisages installation of the fixtures on one rib of a place at intervals of 15 to 20 ft. With two 14-watt tubes per fixture, such an arrangement provides 2 to 5 foot-candles in the middle of the opening — not much by factory or office standards but positively brilliant in a coal mine, as those who visited or worked with the experimental installations can testify.

With rib suspension at 15- to 20-ft intervals the installation problem becomes one of hanging fixtures at the specified intervals and connecting with the cable sections. The arrangement employed by one mine where experimental work was carried on is shown in the accompanying illustration. It was at this property that the data on increased productivity and decreased injuries previously cited were obtained.

A possible future section might conceivably be a single place a thousand or so ft deep. Spacing and installation methods would be the same, though the total number of light fixtures could vary.

Haulage and Travelways

Though the problem is perhaps not as urgent, experience has shown that lighting of haulage roads and openings travelled to any considerable extent by men can provide efficiency and safety benefits normally sufficient to make the investment worthwhile. Since such openings are on fresh air and the lighting installations are at least semipermanent if not fully so, installation, maintenance and servicing are eased.

Illuminating haulageways, for example, also is simplified by the fact that a relatively low level of illumination — perhaps as low as ½ foot-candle — will suffice, provided it is uniform — no conspicuously light or dark spots — and is without glare.

In one instance, experiment resulted in the conclusion that 150 W of incandescent capacity, divided into a cluster of three 50-W lamps, with a spacing of 70 to 90 ft between clusters, provided a satisfactory level of illumination of a little less than 1 foot-candle. The clusters were mounted on one rib, which was found preferable to the first idea of centering on the roof. The lamp filaments provide their own short-circuit protection. Initial cost of the installation was $6 per cluster in 1956, or 7c per foot of haulageway.

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As long as pressures are excessive, the Yieldable Arch will continue to "give." As soon as stability is reached, the Arch holds the line.

A Yieldable Arch Set consists of curved U-shaped sections nested together and overlapped enough to permit clamping with husky U-bolt clamps. The clamps control the tightness in the joint, and permit yielding when the forces exceed the load for which the joint was intended. Each Arch set is connected to adjoining sets by means of horizontal struts, which add lateral rigidity to the structure.

Besides increasing mine safety, the Yieldable Arch offers high salvageability, and usually pays for itself within its first year of service. A Bethlehem engineer would like to discuss the Yieldable Arch with you. You can reach him through the nearest Bethlehem office.

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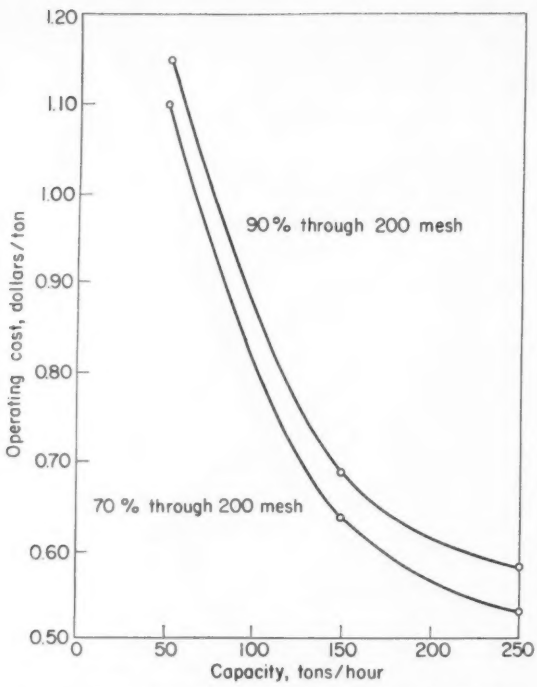


FIG. 1—Effect of plant capacity on cost of pulverizing.

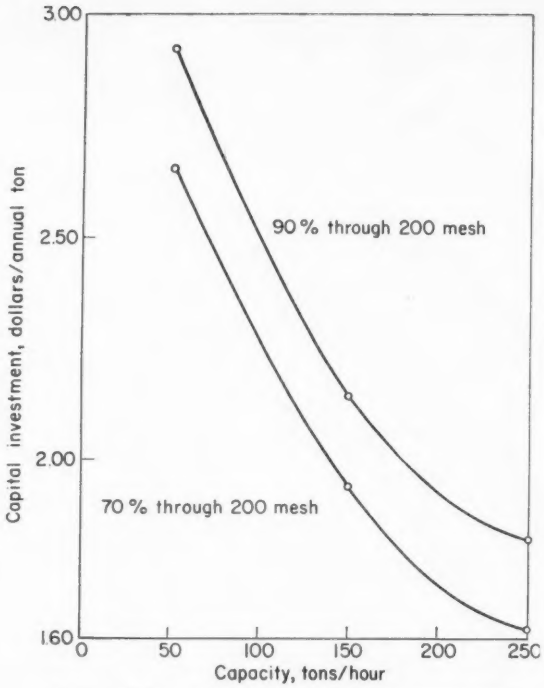


FIG. 2—Effect of plant capacity on investment cost.

What Pulverizing Costs

USBM study develops commercial-scale costs of pulverizing coal to 70 to 90% through 200M, using hammer and balls mills, for such applications as production of synthetic liquid fuel and gas, or pipelining.

Sidney Katell, Project Coordinator, Technical Evaluation of Processes

Thomas J. Joyce, Chemical Engineer, U. S. Bureau of Mines, Morgantown, W. Va.

MANY of the coal-utilization processes being developed by the U. S. Bureau of Mines require laboratory quantities of a coal that has been pulverized to 70 to 80% through 200M. One phase of the study seeks to determine costs of commercial-scale handling, crushing, drying, and grinding of a bituminous coal with an average Hardgrove grindability of 55.

Various types of grinding equipment are available for producing the desired fineness. These include hammer, ball, roll, rod, impact and bowl mills. For the study reported here, a hammer mill was selected to reduce run-of-mine coal to minus ½ in, and a ball mill was picked for the final grinding. The quantities of coal pulverized would be 50, 150 and 250 tph in a plant operating on a 90% annual load factor. The systems would be designed in accordance with the National Fire Protection Association "Standard for the Installation and Operation of Pulverized Fuel Systems."

Plant capacity and size of final product were found to be the two variables with a major effect on costs. Of the two, plant capacity has the greater. To illustrate: the operating cost without return on investment for a system handling 50 tph and grinding to 70% through 200M is estimated at $1.10 per ton, while the operating cost of a 250-tph system is $0.53

Table I—Operating Cost, Per Ton

Operating-Cost Components	50 Tph A*	50 Tph B*	150 Tph A*	150 Tph B*	250 Tph A*	250 Tph B*
Power	$0.22	$0.25	$0.20	$0.23	$0.19	$0.22
Labor	.17	.17	.07	.07	.05	.05
Supervision	.03	.03	.01	.01	.01	.01
Payroll overhead	.06	.06	.03	.03	.02	.02
Maintenance & supplies	.23	.23	.10	.10	.08	.08
Indirect costs	.21	.21	.09	.09	.07	.07
Property taxes & insurance	.05	.06	.04	.05	.03	.04
Depreciation	.13	.14	.09	.10	.08	.09
Total	1.10	1.15	.63	.68	.53	.58

*A, 70% through 200M; B, 90% through 200M.

per ton. Pulverization to 90%, rather than 70%, through 200M results in an addition to the power required for the ball mills and also in the need for larger units for the same capacity. However, the resulting increase in operating cost would be constant at $0.05 per ton for all plants in the 50- to 250-tph range.

The Reduction Problem

Many processes for converting coal to a synthetic liquid or gas require that the raw material be pulverized. Coal also is pulverized prior to pipeline transportation and for use in many boiler installations.

The four major variables affecting the design and attendant costs of coal pulverization systems are: (1) physical characteristics of the coal, such as grindability; (2) moisture content; (3) capacity of the system; and (4) final size of coal.

The factor of grindability is related to the capacity of the mill—the higher the grindability index the higher the capacity. However, the mill capacity is not directly proportional to the grindability. For example, a 10,000-lb-per-hr mill with a coal of 50 Hardgrove grindability would be able to handle about 16,000 lb per hr if the grindability index is 100.[1] Moreover, the factor of grindability is interrelated to the moisture content of the coal. If there isn't enough drying air, then the mill capacity will be limited to the drying rather than to the grinding capacity.

In this analysis, the bureau has assumed the availability of a coal with a Hardgrove grindability index of 55 and an initial moisture content of 4%. The specification for the final product has been established as either 70 or 90% through 200M. The moisture would be 1.4%.

Coal-Handling System

Run-of-mine coal, either from the coal-unloading hopper or the storage pile, is conveyed to a hammer-mill feed hopper. From the hopper, coal is fed by apron feeders to hammer mills, where the size is reduced to minus ¼ in—suitable for feed to the ball mill.

The product from the hammer mills is carried in enclosed conveyors to crushed-coal storage bins and then to the feed hoppers above the ball mills. Table feeders admit coal to the mills at a constant rate and tend to maintain constant operating conditions in the mills. In the mills, the coal is subjected to impact, attrition and shearing. The larger pieces are broken by impact and the fine grinding is done by the rolling and sliding action of the balls until the required fineness is reached.

Hot air sweeping through the mills picks up the coal and carries it to the classifiers, where the oversize is rejected and returned to the mills. Meanwhile, the ground coal that meets requirements is carried by the air to the cyclones above the feed hoppers or the pulverized-coal storage bins. The coal then flows either to the bins and is withdrawn, as required, at the burners or is fed directly to them.

Drying Air

To insure proper operation of the ball mills, the moisture content of the pulverized coal must be held fairly constant. To accomplish this, most present-day ball mills use heated air that both dries and conveys the fine coal from the mills. The moisture content of the coal being fed to the ball mills may vary. However, in normal operation, a 1 to 2% increase in the design moisture content of the coal will show no appreciable effect on ball-mill capacity. If the moisture content should be above this limit, the effect, at constant air temperature and flow conditions is to reduce the coal-air mixture temperature. If this temperature drops below about 160 F, a decrease in mill capacity will occur.

The two remedies available are: (1) increase the airflow, or (2) raise the temperature of the air. However, the first approach may cause increased loading on the classifiers. Fewer changes in the system result from increasing the temperature of the drying air. The maximum air temperature is considered to be 500 F, but some systems have operated as high as 600 F.

1. de Lorenzi, Otto, *Combustion Engineering*, Combustion Engineering Co., Inc., New York 16, N. Y.; 1948, pp. 7-11 to 7-17.

Economics

The following assumptions were used to establish the operating costs for this study:

1. Cost of power—$0.0075 per kw-hr.
2. Cost of direct labor—$2.50 per man-hour.
3. Supervision—20% of direct labor.
4. Payroll overhead—18.5% of payroll.
5. Maintenance labor—$2.70 per man-hour.
6. Indirect costs—50% of the total cost of labor, maintenance and supplies.
7. Property taxes and insurance—2% of capital investment.
8. Depreciation—5% of capital investment.
9. Operating factor—90%, or 330 days per year.

Using these assumptions, the total operating costs were estimated as in Fig. 1. Table I details the components.

The relationship shown in Fig. 1 exists because direct labor and indirect costs are much higher, per ton of coal, in a small plant than in a larger plant. For example, of the $0.47-per-ton difference in operating costs between 50- and 150-tph plants, $0.40 per ton is due to direct labor and related indirect costs, whereas the incremental difference between 150- and 250-tph plants due to direct labor and indirect costs is only $0.07 per ton.

Return on investment has not been included in the operating cost, but Fig. 2 shows the estimated capital investment cost for the plants of varying capacity and varying product size, and can be used to calculate this incremental cost. For example, in a 250-tph plant grinding to 70% through 200M, the capital investment would be $1.62 per annual ton. The cost of 6% return on this investment would then be 6% of $1.62, or $0.10 per ton, and the total production cost would be $0.53 per ton, plus $0.10 per ton, or $0.63 per ton of coal pulverized.

Electric Utility Fuel by Regions—1960 Burn with Prediction for 1965

(All figures in millions of tons coal or coal equivalent)

	Coal		Oil		Gas	
	1960	1965	1960	1965	1960	1965
New England	5.9	7.7	3.9	4.3	.5	.5
Middle Atlantic	34.0	40.8	6.0	6.9	3.6	4.0
South Atlantic	27.2	38.1	3.4	7.4	5.9	6.0
East North Central	69.8	90.8	.3	.3	2.5	3.4
East South Central	26.8	40.2	n	n	2.1	2.9
West North Central	10.0	14.4	.4	.6	9.8	13.3
West South Central	n	n	n	n	26.2	41.4
Mountain	2.8	7.5	.6	.6	5.4	4.8
Pacific	n	n	5.8	8.1	12.9	18.1
	176.5	239.5	20.4	28.2	68.9	94.4
					1960	1965
Total fuel					265.8	363.5

n—negligible.

Increased Fuel Tonnages Required by 1965, by Regions

All figures in million tons coal or coal equivalent

	Coal	Oil	Gas
New England	1.8	.4	0
Middle Atlantic	6.8	.9	.4
South Atlantic	10.9	4.0	.1
East North Central	21.0	0	.9
West North Central	4.4	.2	3.5
East South Central	13.4	0	.8
West South Central	0	0	15.2
Mountain	4.7	0	−.6
Pacific	0	2.3	5.2
	63.0	7.8	25.5

Utility Coal in 1965 . . . 63-Million-Ton Increase

Eighth annual survey of electric-utility fuel-burning plans shows annual average growth of 12 million tons, and a 5-yr increase of 36%. By 1965, coal will be used to generate electricity in all but five states.

THE NATION'S ELECTRIC UTILITIES will require 63 million tons more coal by 1965, according to results of the 8th annual survey of fuel-burning plans conducted by *Keystone Coal Buyers Manual*, a *Coal Age* affiliate. The average growth thus becomes 12 million tons per year, and the 5-yr increase, to 1965, is 36%.

Coal's long-range downward trend is being reversed in areas where the loss has been great, and it is winning new customers competitively. In the Mountain States, *new* utility demand alone calls for 50% more coal by 1965. Arizona Public Service and the City of Colorado Springs have decided to switch from gas to coal. Southern Nevada Power is including coal equipment in its new unit. Utah Power & Light's new units will be coal-burning mine-mouth plants.

Coal men have capitalized on volume freight rates, mine-mouth locations and high-voltage transmission to win the fuels battle in this region where gas has enjoyed 65 to 75% of the business. By 1965, coal will enjoy 65%. In addition, the percentage of hydro will decrease. And two more states—Arizona and Nevada—will be added to the coal-burning list, supplementing Texas and Florida, where coal won out over gas and oil a few years ago.

Alabama's utility increase in the next 5 yr will be 5.5 million tons, a percentage rise of 85% in utility coal demand and 42% in total production in the state. Biggest part of the added tonnage will go to Alabama Power and Southern Electric Generating with

Potential Sources of Increased Utility Coal Demands by 1965

	1960[1] Total Production	1960[2] Shipments Utility Coal	Increased[3] Utility Demand by 1965	% Increase Utility Coal
Penna. Bit.	66.7	23.2	3.4	14.6
No. West Virginia	35.5	22.2	8.9	40.5
Ohio	34.0	20.4	6.1	30.0
So. W. Va., Va., E. Ky., Tenn.	158.6	35.4	12.0	33.6
West Ky.	30.0	22.3	8.6	38.6
Illinois	46.0	26.4	9.1	34.5
Indiana	14.5	9.7	2.5	26.0
Alabama	13.1	6.5	5.5	84.6
Iowa, Kansas, Missouri	4.3	3.3	1.3	40.0
N. Mex., Colo., Utah, Wyo.	10.9	2.8	4.9	175.0
North Dakota Lignite	2.5	1.6	.4	25.0
Pennsylvania Anth.	19.0	2.7	.3	11.1
	435.1	176.5	63.0	35.8

(1) U. S. Bureau of Mines. (2) U. S. B. of M. and Federal Power Commission. (3) Calculated, by *Keystone*, from survey data and other known factors.

new units totalling over 1,000,000 kw. High hopes are held for Alabama increasing its share of the Florida coal demand and even of bringing another state, Mississippi, into the coal-burning ranks. Coal can move down the Warrior River across the Inter-coastal waterway and directly into the bunkers of the new plant on Biloxi Bay.

Western Kentucky's potential share of the 63-million national increase is about 8.6 million tons, some 40% more than the 22.3 of utility coal shipped in 1960. Tennessee Valley Authority's new Paradise plant alone will consume 4 million tons per year by 1965 in the world's two largest generating units (the second one recently ordered is rated at 900 MW).

Coal's Reach Lengthens

Reaching much farther out to the North, East and South will bring coal more tonnage. In these more-distant areas coal men also see the possibility of switching gas-burning states and utilities to coal. Likeliest prospects include Arkansas and Louisiana. Both river transportation (Mississippi, Ohio, Tennessee, Green) to consuming areas and mine-mouth locations feature western Kentucky's drive to increase its share of the utility fuel demands. Imported Canadian gas threatens in Wisconsin, where one utility now shows plans to use some gas in 1961, but the big drive to sell this gas seems concentrated in the home and industrial markets.

Surprisingly, northern West Virginia outranks western Kentucky in potential gain with 8.9 million tons, some 41% above 1960's 22.2-million-ton utility shipments. This is in spite of the fact that in upstate New York, one of the area's major markets, it is losing some 2 million tons a year to Niagara-St. Lawrence hydro developments.

Biggest surprise is the projected increase in coal tonnage along the Atlantic Seaboard. Both New England and Middle Atlantic regions project little increase in gas and oil, while showing most of their expansion as coal-based. Not counted in this survey is the potential export to Ontario's Hydro Commission, which begins its move to coal this year (1961) by taking some 500,000 tons (200,000 from Nova Scotia), presumably for stock piles at new plants. By 1965, this could grow to between 2½ and 5 million tons, with northern West Virginia and Pennsylvania most likely to enjoy the largest portion of this new demand.

Some Utilities Showing Sizeable Growth in Use of Fuel—

	Increased Needs (Million Tons)
Coal	
Philadelphia Electric	1.2
Public Service Electric & Gas (N. J.)	1.2
Monongahela Power	1.3
Detroit Edison	1.6
Consumers' Power	1.7
Commonwealth Edison	2.3
Union Electric	1.3
Ohio Power	1.1
Wisconsin Electric Power	1.1
Indiana Michigan	2.0
Alabama Power	1.1
Southern Electric Generating	1.6
Tennessee Valley Authority	9.0
Arizona Public Service	2.6
Gas	
Northern States Power	.4
Louisiana P. & L.	.5
Mississippi P. & L.	.4
Southern P. S.	1.1
Southwestern E. P.	.4
San Antonio	.4
El Paso	.3
Central P. & L.	.7
Austin	.5
Dallas	.7
Texas E. S.	1.0
Gulf States Utility	1.7
P. S. Oklahoma	.6
P. S. New Mexico	.4
Tucson G. & E.	.4
Oil	
Florida Power	.8
Florida Power & Light	2.6
Jacksonville	.4

Illinois, Indiana and Ohio all show potential gains of from 25 to 35% in utility coal, with good gains in each of the three states and in Michigan and Wisconsin also.

The District Picture

Districts 7 and 8, comprising Virginia, southern West Virginia, eastern Kentucky and northern Tennessee show the biggest potential gain in tonnage, 12.0 million tons, equivalent to 34% of shipments of 35.4 million tons in 1960. TVA will account for possibly one-third of this increase. Expansion in Virginia, North and South Carolina and Georgia, as well as in Kentucky and Tennessee, will account for most of the balance. Gas, in these market areas, appears to be losing ground. Just recently, for instance, Georgia Power switched from gas to coal to the extent of about 1 million tons per year. Coal men and railroad men combined to figure ways to beat the gas competition.

Pennsylvania, traditionally having a small percentage of utility coal, shows a 15% potential increase. Most of this moves within the Commonwealth, or north into New York. Not included in this potential is the possible demand to come from Ontario's Hydro Commission.

Iowa, Kansas and Missouri show a potential increase of almost 40% over their 1960 utility shipments of 3.3 million. Both North Dakota lignite and Pennsylvania anthracite show up with only minor—but nevertheless—gains.

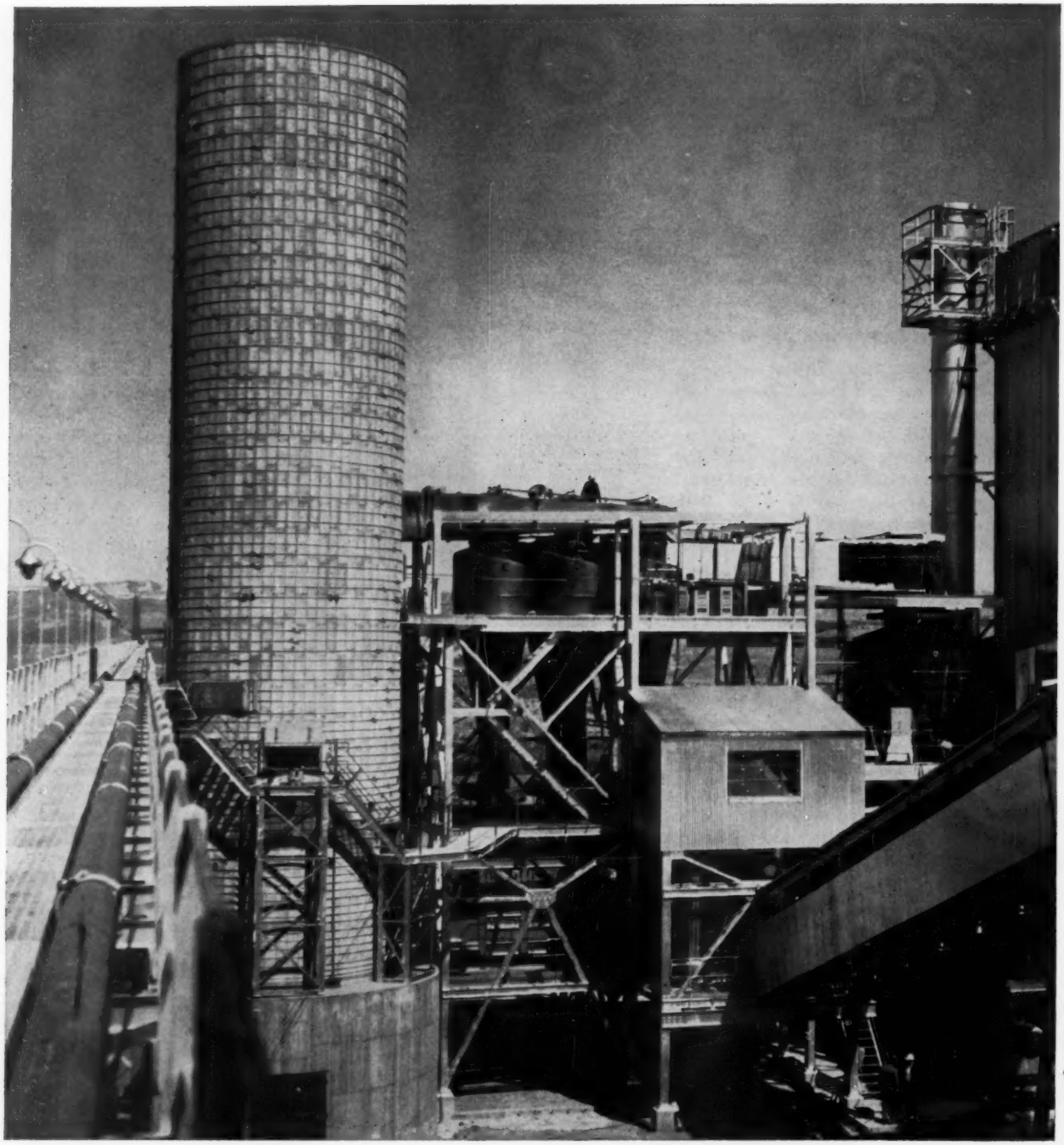
Coal, in fact, shows gains in every area, with competitive infiltrations into gas territory following the competitive gain in oil territory a few years ago.

All But Five

It is now possible to predict that coal will be used in every state in the Nation for generation of electricity by 1965, except Hawaii, Idaho, which will remain all hydro; and Washington, Oregon and California, whose fuel will remain oil and gas (possibly divided 30-70) through these 5 yr. In addition, American coal for generation of electricity will move into Canada and continue to move overseas.

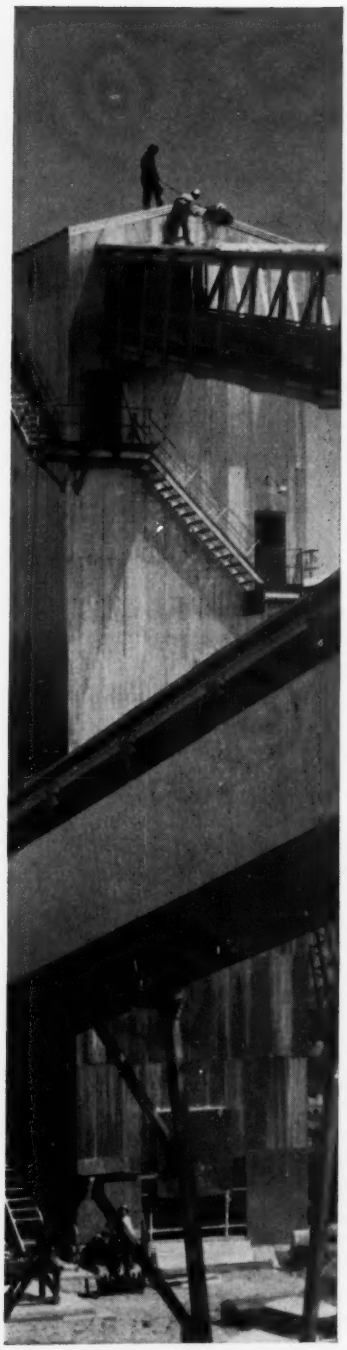
Foreign residual oil shows potential gains in Florida, California and along the northern Atlantic Seaboard. Our own oil industry has almost no markets left in the electric-utility industry.

Natural gas shows its biggest potential in the West South Central Region. Despite coal's winning of the Arizona Public Service business, gas still shows a gain of some 15 million tons. Other gains are shown for the Pacific Region (mostly California) and for the West North Central Region. It seems safe to predict that more than half of the 8.7-million-ton increase predicted for this area will go to imported gas from Canada.



USS Columbia-Geneva Steel Division selects FluoSolids® drying

at major coal preparation facility



The FluoSolids dryer placed on stream in mid 1960 at the United States Steel Corporation's giant new coal preparation facility at Wellington, Utah marked the second major USS installation to select this most advanced drying technique. The new unit followed the successful operation of two 14′ I.D. dryers at a major East Coast coal preparation plant.

Located adjacent to the ten story high structure in the foreground, the FluoSolids Dryer at Wellington is removing 25 tph of water from 800 tph of 1½″ x 0 metallurgical coal destined for steel making at Geneva Works near Provo, Utah.

First introduced by Dorr-Oliver in 1954, FluoSolids has enjoyed phenomenal success and has caused a revolution in thermal drying of coal. And the basic simplicity and efficiency has remained unchallenged to date.

The compact, unitized design conserves space, simplifies operation and realizes maximum use of heating BTUs. Burning pulverized coal automatically extracted from the drying compartment, the FluoSolids system provides rapid start-up and shut-down . . . no fuel is consumed during shut-down as with banked stokers. Control is accurate and automatic and quickly responds to varying feed conditions. Hot air supplied to the drying compartment is pressurized, no exhaust fans being needed to handle hot, dirty gases. Uniform product control is assured through automatic feed rate adjustment and temperature control. Positive humidity control conditions give uniform drying. Compared with other systems, lower air volumes are required with corresponding savings in horsepower.

Applicable to a wide variety of tonnages and feed sizes ranging from filter cake on up to 1½ x 0 coal, the Dorrco FluoSolids system is the most advanced equipment available to meet today's demands for automation and efficiency in economical preparation plant operation. For complete information, write Dorr-Oliver Incorporated, Stamford, Connecticut.

DORR-OLIVER

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

What You Can Expect From Fire-Resistant Fluids

The present status of water-in-oil emulsions, future possibilities, operating and economic advantages or disadvantages, how they are sold (premixed or concentrated), and emulsion types and costs.

YOU MAY BE REQUIRED BY LAW within the next year or two to use fire-resistant fluids in all underground machinery equipped with hydraulic power. If this should happen, what are your chances of using the fluids successfully and what operating and economic advantages or disadvantages can you expect from these fluids? Some light on this subject has been shed by David H. Michael, general manager, Hulburt Oil & Grease Co., Philadelphia, in a paper presented at the 1961 spring meeting of the West Virginia Coal Mining Institute. Following are excerpts from his paper:

Present Status

Fire-resistant fluids have been a matter of much controversy. But, at the same time, it has continued to be of increasingly great interest to the mining industry. The lack of knowledge about fire-resistant fluids, the misconceptions, the sad experiences encountered by some operators in using them, the negative or neutral position necessarily taken by equipment suppliers and the existence of poor fluids on the market with subsequent withdrawal add up to the general confusion and therefore skepticism about fire resistant fluids.

No one can be positive how good certain emulsions may be at this moment. We can be well informed on what they were a few months ago. And it should be kept in mind that the reputation of emulsions at this moment is based on field performance over the past few years. Field performance in the early stages was not too good and slow acceptance of these products by the coal industry and condemnation by some pump manufacturers bear out this statement.

Our laboratory data also indicate clearly that most emulsions are not what they should have been. These poor emulsions have been a "thorn in the side" to the better emulsions and have slowed down their acceptance. But they have not slowed down the acceptance of the best emulsions too much. A representative of the USBM, in a paper presented at an American Society of Lubrication Engineers' meeting, stated that his studies indicated that there were about 100 coal mines now using emulsions.

We know that one company has 50 coal mines using its emulsion. Ten coal mines are using an emulsion 100% on all hydraulic equipment, and report lubrication cost per ton sharply reduced in every case. If their lubrication cost was not reduced and if their pump life and efficiency was not equal or better, they simply would not be using the emulsion 100% in all hydraulic equipment. It is as simple as that. Therefore, we say the best emulsions are very good. They will mine coal more efficiently and at a lower cost. Even if they did not have fire resistance they would be sold today because they reduce cost and improve performance. The greater safety is an extra bonus and an important one.

Advantages and Disadvantages

The advantages of emulsions compared with conventional petroleum hydraulic fluids are:

1. Lower operating temperatures (10 F to 15 F).
2. More efficient pump operation.
3. Best emulsions can mine coal more efficiently at a lower cost per ton.
4. Fire resistant.

All emulsions should tend to lower operating temperatures approximately 10 F to 15 F because of the 40% water which must per present in the system. Water is a better heat transfer medium than petroleum oil and therefore the heat escapes more readily.

With the best emulsions you can expect more efficient pump operation. Since the system is operating at a cooler temperature, the viscosity of the fluid increases. Increased viscosity aids pump efficiency. By pump efficiency, we do not mean the life of the pump parts but rather the ability of the pump to deliver full volume at full pressure throughout an entire operating shift. It further should be mentioned that certain emulsions, by the use of certain antiwear additives, can maintain a type of metal surface at point of contact which markedly affects pump efficiency. This important characteristic of some premium hydraulic fluids has always been available in some conventional premium petroleum fluids and is also available in some emulsions.

The disadvantage of emulsions compared with conventional petroleum hydraulic fluids is slightly less tolerance for malpractices commonly encountered in coal mines, i. e., foam, dirt and temperature in the system. However, it has now been proven in field service on hundreds

of applications of emulsions that these apparent disadvantages are actually being turned to advantages by progressive mining operators.

Consider the problem of foaming in a hydraulic system. Because a stable emulsion entraps and holds water, it may have a slightly greater tendency to trap and stabilize air in a system. Emulsions inherently have a detergent or cleaning effect on a hydraulic system, which tends to loosen dirt and, relative to petroleum oil, may slightly tend to hold and suspend the dirt in the system.

Emulsions cannot be used at temperatures such as 210 F because the water will boil out. Water also boils at lower temperatures when at lower than atmospheric pressure or when under partial vacuum conditions, such as the suction side of a pump. Therefore, we generally feel that 180 F to 185 F is the upper temperature limit for use of emulsions.

Hydraulic systems should not have air leaks, should not have excessive dirt, and, with any fluid, should never operate over 185 F. With an air leak in the system using petroleum oil, you may get by but you are losing pump efficiency, pump life and coal production every minute of operation. If the use of an emulsion forces you to eliminate the air leaks the emulsion characteristic becomes a benefit rather than a disadvantage.

The same principle applies with dirt. With an emulsion in combination with return micronic filtration, hydraulic systems can be cleaner than ever. Thus the detergency characteristic becomes a benefit.

Most companies are offering their emulsions in either concentrate or premixed (ready to use) form. The concentrate is shipped from the factory and mixed by the coal company. The premixed is shipped ready for use with no initial preparation.

Emulsions are either chemical or mechanical. A chemical emulsion is one incorporating chemicals which are soluble in water and oil. These chemicals are attracted to water or to oil. By balancing one chemical against the other, the water is held in its proper place. This type of emulsion system is then a chemical balance. In contrast to the chemical emulsion, we have what may be termed a mechanical emulsion. This type of emulsion is achieved primarily by the use of solid thickeners which build up a physical or mechanical structure. This gel-structure holds both oil and water in suspension. A stable form of emulsion is thereby created.

Initial price of emulsions is of concern only as it affects lubrication cost per ton. If you are only going to use half as much fluid, then, obviously, you can cut the initial price in half when making comparison with your present initial price for oil. But bear in mind that emulsions vary sharply in their tendency to cut consumption. Do not leave this factor of cost as a matter of conjecture as to the accuracy of a supplier's claims. Many of you are connected with large coal companies where the positive determination of savings may amount to up to $50,000 per year. Why guess about a matter so important when you can run a test on a pump stand or in your mine or preferably both? You can establish on your own at little expense that one emulsion costing possibly less than the other may actually cost you twice as much on a cost-per-ton basis.

A comparision of wear properties of hydraulic petroleum fluids and emulsions is as follows:

Product	Rating
Premium petroleum oils	8 - 10
Best emulsions	7 - 9
Cheap oils	4 - 2

Get to Know Your Service Shops Better

Rising maintenance costs have prompted management to take a second look at custom service shops. They are hunting for shops that will best serve them. If they cannot find them they will set up their own facilities at the mine.

COAL COMPANIES depend a great deal on custom service shops to repair and rebuild equipment components, such as, motors, conveyor belting, cables, hydraulic parts, etc. By doing so they are able to eliminate or reduce repair facilities and labor at the mine. Companies using these services expect:

1. Quality workmanship and material.
2. Reasonable price.
3. Good service.

There may be others, but these are the standards which a coal company uses to judge whether or not custom service shops will be part of the overall maintenance structure. It is common practice to look around to determine which shop will provide the best in all three categories. It is not enough in most cases, for a service shop to do a good job in only one or two categories. All three are essential.

One company, for example, conducted a test to find out something about hydraulic repair shops. Here's what it did, what it found out and what it did as a result.

A hydraulic pump known to be good was sent to a repair shop to be checked. All components within the pump were marked. The pump was returned in working condition. The bill was $89, including labor and parts. After

checking the markings on the parts it was found that no parts had been replaced.

The same pump was then sent to another shop after it had been retested by the company and found to be in good working order. It came back with a $45 bill attached. No parts had been replaced but the pump would not work. It was fouled tight.

The pump again was put in operating condition and sent to a third shop. It was returned with a $30 bill attached. The pump was in good condition but a test showed that it had not been broken in or even tested by the service shop before it was returned.

In the light of these experiences, the coal company set up its own hydraulic repair shop. Management did not necessarily want to take this step but had no other choice.

Citing this one experience does not imply that all service shops are alike. The important thing to remember is that there are good ones and poor ones and it is essential that you know which is which.

From a performance standpoint quality workmanship and material are absolutely necessary if performance of the rebuilt components is to match the original.

No coal company expects a service shop to operate without a profit. What most companies object to is the inflated or false prices that some shops charge for service and parts. Most companies are capable of evaluating the cost of these services and know when prices are not in line. The one big reason why companies turn to service shops is to eliminate the cost of maintaining equipment and facilities for the various services involved, and to hold down the number of maintenance personnel at the mine.

Good service is without doubt important, especially when emergencies come up. If, for example, a 300-ft section of conveyor belting was torn up you, more than likely, would need the services of a belt-repair shop. A shop equipped with the necessary facilities and manpower to make the repairs on the job or in the shop as quickly as possible must be called in.

The same holds true if a motor burns up. You need fast service. The only way to get it is to call a shop equipped to give that kind of service. Cable repair, machine, and other shops must also have these features.

Independent service shops can provide a valuable service to the coal industry. It is up to the coal companies to decide which of the various service shops will do the best job on a routine or emergency basis and to support those that do. The only way they can do this is to get to know service shops better.

Glossary of Electrical Terms

Circuit Grounding

Grounded – Grounded means that the system, circuit, or apparatus, referred to is provided with a ground.

Ungrounded – Ungrounded means that the system, circuit, or apparatus, referred to is without an intentional connection to ground except through potential indicating or measuring devices or other very-high-impedance devices.

Neutral Ground–A neutral ground is an intentional ground applied to the neutral conductor or neutral point of a circuit, transformer, machine, apparatus, or system.

Grounded Circuit–A grounded circuit is a circuit in which one conductor or point (usually the neutral conductor or neutral point of transformer or generator windings) is intentionally grounded, either solidly or through a grounding device.

Degree of Grounding

Solidly Grounded–Solidly grounded means grounded through an adequate ground connection in which no impedance has been inserted intentionally.

Note: Adequate as used herein means suitable for the purposes intended.

Effectively Grounded – Effectively grounded is an expression which means grounded through a grounding connection of sufficiently low impedance (inherent and/or intentionally added) that fault grounds which may occur cannot build up voltages in excess of limits established for apparatus, circuits, or systems so grounded.

Note: An alternating-current system, or portion thereof, may be said to be effectively grounded when, for all points on the system, or specified portion thereof, the ratio of zero-sequence reactance to positive-sequence reactance is not greater than three and the ratio of zero-sequence resistance to positive-sequence reactance is not greater than one, for any condition of operation and for any amount of connected generator capacity.

Manner of Grounding

Impedance Grounded – Impedance grounded means grounded through impedance.

Resistance Grounded – Resistance grounded means grounded through impedance, the principal element of which is resistance.

Note: The resistance may be inserted either directly, in the connection to the ground, or indirectly, as for example, in the secondary of a transformer, the primary of which is connected between neutral and ground, or in series with the delta-connected secondary of a wye-delta grounding transformer.

Reactance Grounded – Reactance grounded means grounded through impedance, the principal element of which is reactance.

Note: The reactance may be inserted either directly, in the connection to the ground, or indirectly by increasing the reactance of the ground return circuit. The latter may be done by intentionally increasing the zero-sequence reactance of apparatus connected to ground, or by omitting some of the possible connections from apparatus neutrals to ground.

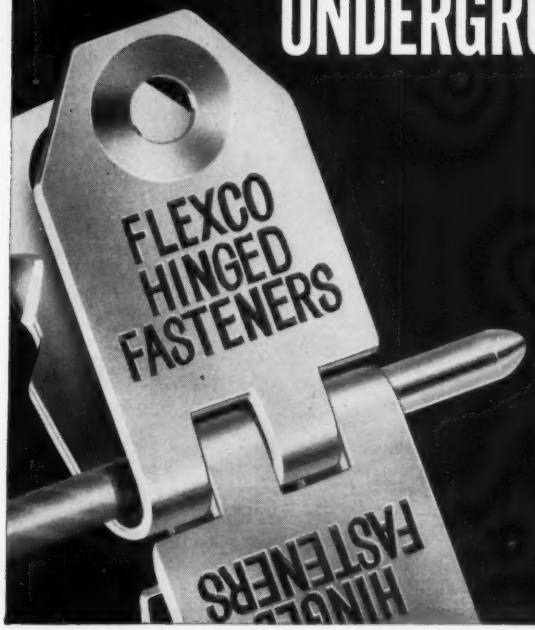
Ground-Fault Neutralizer Grounded –(Resonant Grounded)–Ground-fault neutralizer grounded means reactance grounded through such values of reactance that, during a fault between one of the conductors and earth, the rated-frequency current flowing in the grounded reactances and the rated-frequency capacitance current flowing between the unfaulted conductors and earth shall be substantially equal. In the fault these two components of current will be substantially 180 degrees out of phase.

Note: When a system is ground-fault neutralizer grounded, it is expected that the quadrature component of the rated-frequency single-phase-to-ground fault will be so small that an arc fault in air will be self-extinguishing.

Voltage to Ground–The voltage to ground is the voltage between any live conductor of a circuit and the earth.

Note: Where safety considerations are involved, the voltage to ground which may occur in an ungrounded circuit is usually the highest voltage normally existing between the conductors of the circuit, but in special circumstances higher voltages may occur.

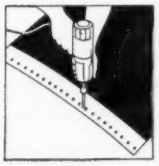
STRAIGHT TALK ABOUT FASTENERS FOR UNDERGROUND HAULAGE BELTS!



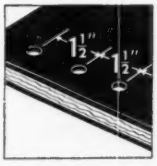
It makes good sense to splice your underground belts with the best fasteners made. Think of the investment you have in belting . . . the importance of holding to production schedules . . . the added protection for miners who work around these belts. Play it safe! Use FLEXCO® HINGED compression type fasteners . . . and save!

9 GOOD REASONS WHY FLEXCO HINGED FASTENERS MAKE THE BEST BELT SPLICES!

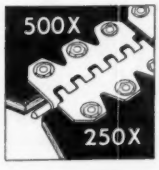
1. TREMENDOUS HOLDING POWER—provide maximum holding strength and pull-out resistance in both *new* and *old* belting.



2. POSITIVE APPLICATION — no guesswork! Templet provides for correct number and proper spacing of fasteners for any width belt.

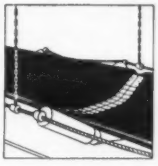


3. FEWER HOLES IN BELT — carcass deterioration held at a minimum (unlike perforating type fasteners which weaken belt with many damaging holes).



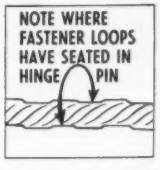
4. ONE TYPE FASTENER TO JOIN DIFFERENT BELT THICKNESSES—250X, for *thin* belts, will mesh with 500X, for *thick* belts.

5. NO BELT DISTORTION—curved templet corrects for swelling of belt when fasteners are applied. Result: load distributed evenly across entire splice.



6. TROUGHABILITY—splices readily conform to curve of any type troughing idlers on rope suspension or rigid frame conveyors.

7. DAMAGE TO JOINT—any fastener can easily be replaced. Just remove nut and bolt, and substitute new plate.



8. NON-MIGRATING HINGE PIN—pioneered by Flexible. Self-lubricating, steel-tipped nylon covered pin will not work out of splice!

9. COMPLETE JOINT IN ONE CARTON—packed ready to install. Available for any width belt.

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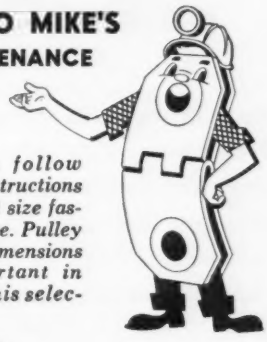

"Always follow mfgr.'s instructions for correct size fastener to use. Pulley and belt dimensions are important in making this selection."

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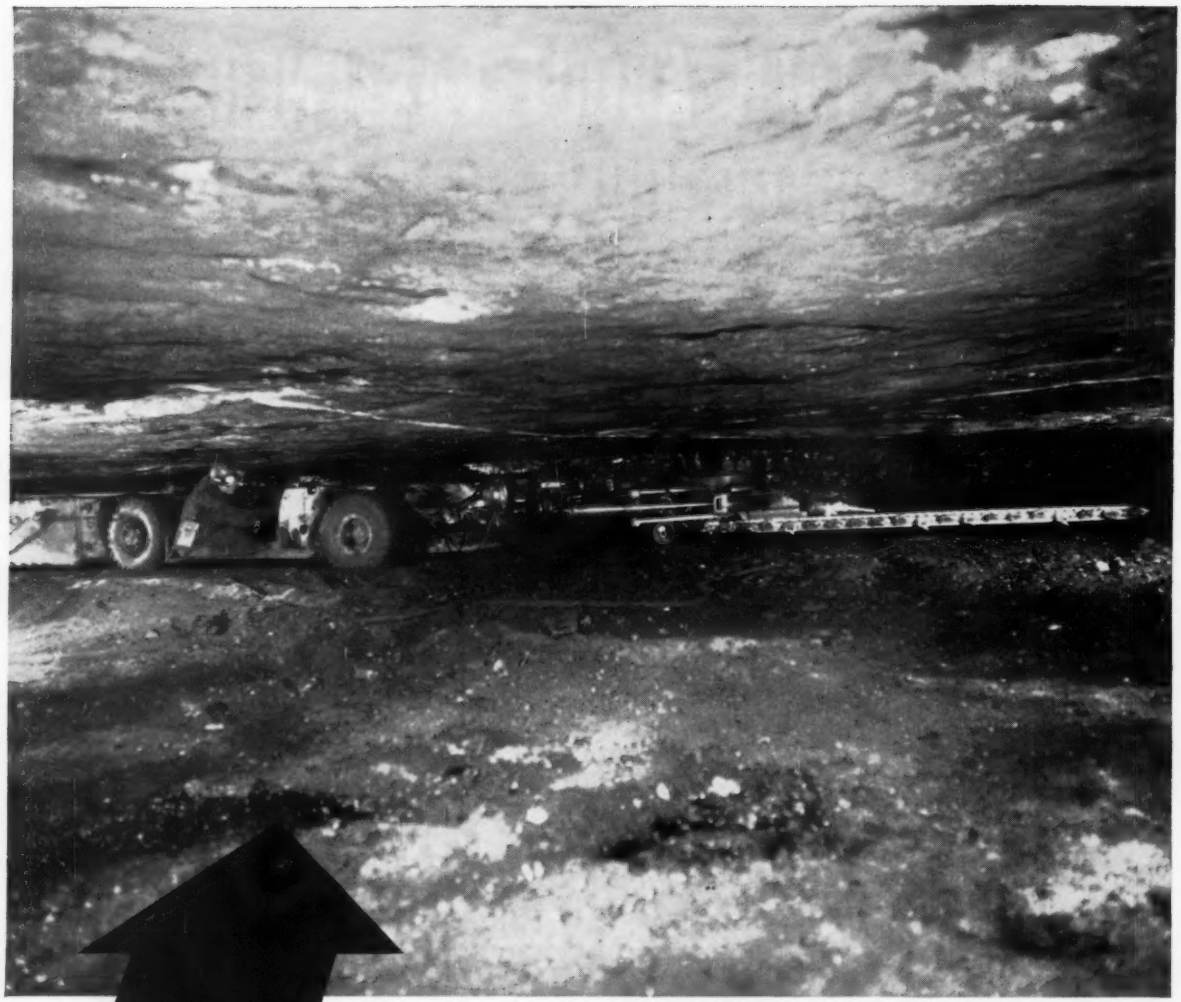

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At Walnut Grove, raw coal is received in a 75-ton hopper and fed to a crusher by reciprocating feeder. A 450-tph belt conveyor feeds 4″x0 raw coal to a McNally Norton Washer. Clean coal goes to two dewatering screens. The 4″x1¼″ and 1¼″x¼″ are directed to loading out conveyors. The under product is sluiced from dewatering screens to the fine coal recovery tank, and pumped to desliming screens. The ¼″x½mm coal is delivered to fine coal dryers and conveyed to two-way loading chutes. The 4″x0, 4″x1¼″, 1¼″x0, or ¼″x0 can be loaded out on either of two tracks.

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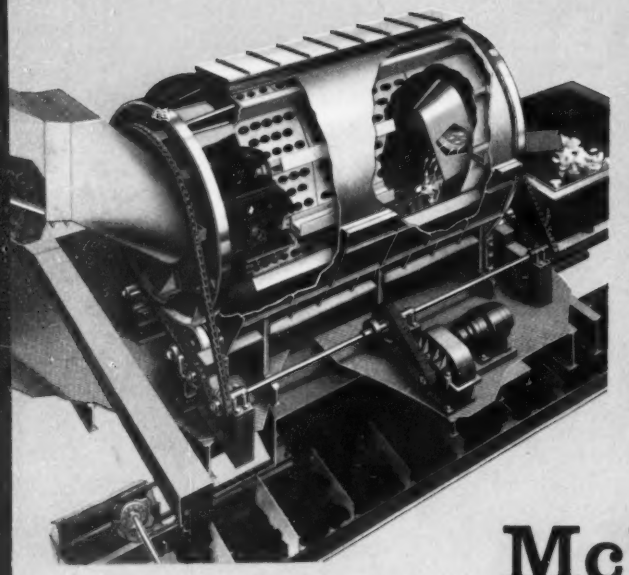

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Midwest Radiant Corp., Millstadt, Ill.
Pioneer Coal Co., Appleton City, Mo.
Pittsburg & Midway Coal Mng. Co., Hallowell, Kans.
Sunlight Coal Co., Boonville, Ind.
Boone County Coal Corp., Sharples, W. Va.
Houilleres du Bassin, Du Nord Doriai, France
Viking Coal Corp., Terre Haute, Ind.
Coiltown Mining Co., Madisonville, Ky.
Stony Point Coal Co., Uniontown, Ky.
Power Coal Co., Montrose, Mo.
Kaiser Steel Corp., Sunnyside, Utah
Paradise Collieries Inc., Paradise, Ky.
West Virginia Coal & Coke Corp., Boyers, Pa.
Blue Diamond, Tilford, Ky.
Yankeetown Dock Corp., Yankeetown, Ind.
United States Fuel Co., Hiawatha, Utah
Dekoven Coal Mining Co., Sturgis, Ky.
Gibraltar Coal Corp., Central City, Ky.
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Kansas City Power & Light Co., Montrose, Mo.
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Lynnville Coal Co., Lynnville, Ind.
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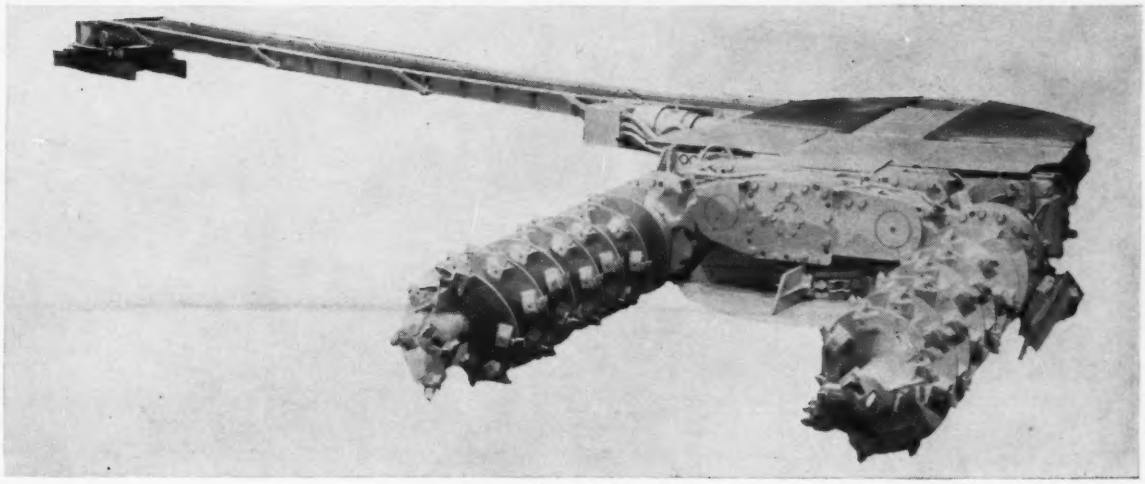


SKID-MOUNTED continuous miner has two hydraulically controlled augers, which can be raised or lowered as coal thickness changes. Unit is 20 in high and 16 ft 10⅛ in long. Maximum cutting height is 48 in.

Thin-Seam Mining With Multiple-Auger Continuous Miners

William A. Hill, General Superintendent Maust Coal & Coke Co., Richwood, Nicholas County, W. Va.

THE FIRST TWO of six Jeffrey Type 100-L miners and Type 94-L bridge conveyors were installed in the Saxsewell mine early in February. The production results of the miners have been gratifying and the expected producivity based on these initial results have made our selection of low-seam miners most satisfactory.

The Saxsewell mine is located at Jettsville, Nicholas County, W. Va., approximately 10 mi southwest of Richwood. The surface area is mountainous and affords good cover over the Sewell Seam.

The Saxsewell mine is an all-conveyor drift mine operating in the Sewell seam. The Sewell coal is a high-quality metallurgical coal with soft structure that lends itself to this type of mining. There are no foreign strata within the seam that are detrimental to full seam mining. The seam is erratic in the Saxsewell property. The height of the seam varies from 25 to 50 in, but approximately 90% of our work is in coal, 29 to 31 in high. The roof is shale and sandstone.

Entry Development

The main entries of the Saxsewell mine include the South Mains, which are the main entries to the outside, and the West Mains driven perpendicular to the South Mains inby the portal. Each is a five-heading system; each heading is driven 20 ft wide on 40-ft centers. A wire-rope-type belt conveyor is located in the center heading of each main.

Room panels, on approximately 740-ft centers by 2,000 ft long, have been driven to the left of the South and West Mains. These panels consist of three headings 20 ft wide on 45-ft centers driven the full length of the panel.

Until recently the production in the panels came from 300-ft long x 40-ft wide rooms driven perpendicular to the panel headings. A partial mining system with no attempt to remove pillars was being used. The extraction was 90%.

Continuous Mining System

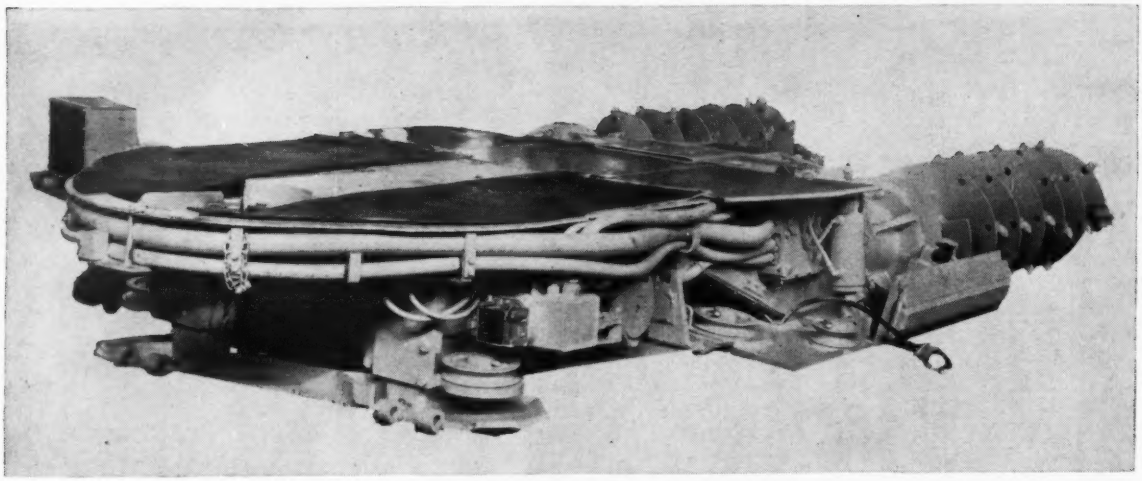
Recently, we attempted a new mining projection which will give greater rate of extraction and a higher productivity as a result of reduction in room move time.

This projection consisted of a three-heading room panel, which was driven the full depth of the panel. The equipment then was moved back and a cross room started just inby the barrier pillar. Multiple rooms were then begun and driven the full length of the panel parallel to the panel entries. The rooms were driven 40 ft wide on 53-ft centers. Thus it was necessary to move only the cross conveyors and room chain conveyors every 300 ft. The face equipment was always in position to mine coal.

When the equipment had mined the rooms the complete length of the panel, the same projection was completed on the opposite side of the panel entries. Thus the width of the panel was limited to 320 ft on either side of the center entry. These dimensions were the same as the previous projection in which rooms were driven perpendicular to the panel entry, and therefore the total projection of the mine was not affected. This is the mining projection in which the Jeffrey Type 100-L miners and bridge conveyors are being applied.

The Saxsewell mine is an all-conveyor mine with a 36-in Long Lo-rope belt conveyor installed in the main entries discharging the coal into a silo. A newly installed belt conveyor receives coal from the silo and trans-

Adapted from a paper presented at the West Virginia Coal Mining Institute.



SHORT LENGTH of machine enables it to maneuver over rolls in thin coal and simplifies roof control. Unit can be tilted about its horizontal centerline, or the front and rear can be raised independently.

ports it down the mountainside to the recently completed preparation plant. Jeffrey 52B 30-in belt conveyors are used in the cross entry and in room panels. Chain conveyors with mobile head-ends are used in the rooms.

Until recently the face equipment included two Wilcox miners, Long 188 loaders and Piggybacks, Joy 12-RB cutting machines, shortwall cutting machines and handheld drills. The coal was shot with permissible explosives.

In 1960, a need for re-evaluation of the mining methods in the Saxsewell property became apparent, and after much deliberation we selected the Jeffrey Type 100-L miner and 94-L bridge conveyors for room work and our Piggyback units for driving entries and brushing top. The two Wilcox miners, being higher than the new Jeffrey 100-L, were moved to another mine on the same property where the coal is higher.

The Multiple-Auger Miner

The Type 100-L miner is a skid-mounted multiple-auger continuous mining machine. The multiple augers are hydraulically raised or lowered to allow for variation in seam height, just as the cutting arms of the Jeffrey Colmols are separated by hydraulic cylinders.

The machine is 20 in high and has a total length of 16 ft 10⅛ in, including the 6-ft augers. The augers are 6 ft long, but have carbide-insert bits on the first 60 in, which is the depth of the sump. Thus the length of the machine from the point that is in the face to the rear of the machine is 11 ft 10⅛ in. This short length reduces to a minimum the number of timbers that must be set by the miner helpers in the face area. This ease of timbering makes it possible to support the top with minimum effort, permitting closer top control. The short length also allows the machine to maneuver over rolls in low seam heights. The 100-L can be tilted about its horizontal centerline, or the front and rear can be raised independently. This maneuverability is definitely an advantage in the conditions encountered in our Saxsewell Mine.

The 20-in, 24-in or 28-in diameter augers can be installed on the machine to give a maximum cutting height to 48 in. The machine has mined in as low as 24½ in in the Saxsewell mine. These particular machines are equipped with 24-in-diameter augers, but with 20-in-diameter augers it appears that the machine could consistently mine coal as low as 24 in in areas where bottom rolls would not interfere.

The 100-L miner is completely powered by one motor. Although located in the center of the machine, we feel that this location will not be a major maintenance problem. Power readings indicate the demand on the motor to be well within the design of the motor and, under these conditions, the motor life is substantiated by years of performance on Colmols throughout the United States. A single motor insures simplicity of control not found in any other machine of this type.

The control case is separately mounted on a skid. This permits use of larger contactors than would be possible on a machine-mounted control—a positive step toward low maintenance.

The conveyor chain is a single-strand heavy-duty paddle-type unit that picks up the coal at the face where it is discharged from the augers and discharges it at the rear of the machine. The direction of travel of the chain can be reversed, depending upon the direction of movement of the machine across the face. The chain travels at a speed of 256 fpm and has a capacity of 4 tons per minute. The minimum restriction is 15 x 8 in, which does not restrict the flow of mined material.

The cleanup has been particularly good with the installation of hydraulically-operated cleanup plows that are extended behind the augers holding in coal to be conveyed to the chain. The plow on the trailing auger is hydraulically moved forward after the 5-ft sump to aid the cleanup as the machine is pulled across the face. The remaining coal at the face is then cleaned up on the next pass. With the installation of the plows, very little coal is left on the bottom for the miner. Friction-disc clutches are located in the 100-L to protect all gearing against excessive overloads. This is another feature that will aid in reducing maintenance costs.

The rope drums are mechanically

driven but the mining speed of the ropes is adjustable by hydraulically controlled friction bands on the planetary gearing. The feed speed of the machine while sumping is 54 in a minute and while tramming is 52 fpm. Drums may be completely disengaged by actuating a hydraulically controlled jaw clutch.

The augers are completely gear driven and are protected by a static friction clutch to prevent overload.

Continuous Mining Plan

Since their installation, these machines have been operating on a three-shift per day schedule. All supplies are taken in on the conveyors at the beginning of each shift by the production crew. Although part of the mining time is taken up by supplying, greasing, installing new bits and conveyor move-ups, this schedule eliminates a preparation and supply crew.

Each of two machines and bridge conveyors are set up in adjoining rooms. These rooms are 40 ft wide on 53-ft centers, driven parallel to the belt entry and the full depth of the panel. A 350-ft room chain conveyor, 15 in wide by 7¼ in deep with mobile head end, is set up in each room. The room conveyors discharge onto a gathering conveyor of the same specifications. At 300-ft intervals the gathering conveyor and the room conveyors are moved up. This move-up is made by the production crew at any time that it occurs in the mining cycle.

When the two rooms are driven to the inby limit of the panel, the machines are moved over to drive two additional rooms again parallel to the belt conveyor entry, but farther from the previous two rooms. These rooms are driven inby to outby of the panel. Thus the equipment will end up at the mouth of the panel, ready for quick transport to the opposite side.

The section personnel includes the following nine men for two machines:

2 miner operators
4 miner helpers
2 miner operators
1 foreman

When the miners were installed, it was necessary to train our personnel in methods of using low-seam miners to insure a more rapid production rate. These men were completely familiar with conveyor mining; however, the use of continuous mining machines was unfamiliar to them. At the outset it became apparent that the miner crew had to work in unison; that is, each man had a particular duty to perform at a specific time in the mining cycle. Teamwork of the crew has been accentuated with gratifying results and we have seen the miner shift production rise steadily. We have not reached the peak yet, and our efforts will continue.

Our production in low seam height is very satisfactory. Our face productivity is 36 tons per man-shift which includes face supervision. This rate is obtained in coal averaging 30 in; and includes supply and maintenance service, and conveyor move-ups. Results of one time study show that the 100-L miner produced 1.6 tons per productive minute in a 26½-in seam.

The production that we have obtained with the 100-L miners has been accomplished with an operating time not exceeding 60% of shift time, including pan-up time. We are steadily improving this mining percentage time which will increase our production.

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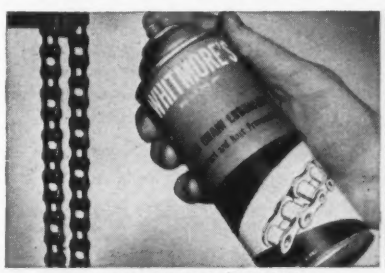

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AMC 1961 Coal Convention Report:

Mine-Tested Methods For Today's Producers

LATEST DEVELOPMENTS leading to higher overall efficiency in the production of coal were presented by industry experts at technical sessions of the American Mining Congress Coal Show at Cleveland, Ohio, May 15-18.

Presiding at the opening session on Monday morning was R. E. Salvati, president, Island Creek Coal Co., Huntington, W. Va., and president of the American Mining Congress. Mr. Salvati keynoted the importance of the equipment displays as a demonstration of the virility of the industry and the progress it has achieved in the recent past. Remarks of welcome were made by Jesse F. Core, chairman, AMC Coal Div., and vice president – operations – coal, U. S. Steel Corp., Pittsburgh. F. Stillman Elfred, chairman of the board, Peabody Coal Co., Chicago, and chairman of the program committee for the Coal Show, also addressed a welcome to the assembly to participate in the sessions.

D. E. Davidson, vice president–sales, Link-Belt Co., Chicago (chairman of Manufacturers Div., AMC), and Robert M. Hardy, president, Sunshine Mining Co., Spokane, Wash., (chairman, Western Div., AMC) greeted the coal men in attendance.

Following are abstracts of remarks presented at the opening session by Dr. C. J. Potter and Hon. John M. Kelly:

National Fuels Policy, Hon. John M. Kelly, assistant secretary for mineral resources, Department of the Interior, Washington, D. C.

Advances scored in production efficiency are a tribute to the coal industry's determination to expand existing coal markets and to find new ones. This farsighted self-enlightenment deserves commendation, and support and cooperation in these endeavors will be found in the Department of the Interior during the Kennedy administration.

The new Office of Coal Research will look long and hard into new uses for coal, especially those having immediate importance. The functions of the OCR will not affect the growth and importance of the types of research conducted by the Bureau of Mines.

The Department of the Interior recently announced its formal endorsement of a balanced, long-range fuels study. It is hoped this study will get underway in the current Congress. None can dispute the right of Congress to undertake such a study. Blind opposition to an impartial study serves no purpose. The test of the public good will be the guiding principle of the study.

It is necessary to know what public policies are required to assure adequate, dependable fuel for the country in order to achieve a balanced, healthy economy. The real public interest must be defined in view of the technical, economic and international problems entailed in fuel-resource development and use.

A Look at Coal's Future, Dr. Charles J. Potter, president, Rochester & Pittsburgh Coal Co., Indiana, Pa.

It would appear that the 1959-61 period should see the bottoming out of coal's severe decline over the past 19 yr. The industry should turn the corner by the end of 1961 and begin a slow but steady climb for 15 yr. It is believed that consumption for 1965, 1970 and 1975 will be 417, 443 and 479 million tons, respectively. Including exports, this would mean production of 510 million tons in 1975.

Basing assumptions on forecasts of power generation in 1975 by the Federal Power Commission–and taking into account the increasing efficiency in coal utilization–minimum coal consumption, in millions of tons, in the United States in 1975 will be as follows:

Electric utilities	305
Coal for coking	87
Cement industry	12
Steel & rolling mills	8
Railroad and bunker	1
Retail	12
Industrial	54
Total	479

Conventional Mining

Conventional Mining of a 28- to 36-in Seam, Clyde H. Storey, director of industrial engineering, Princess Elkhorn Coal Div., Princess Coals, Inc., David, Ky.

The ultimate aim of any mining operation is to maintain a reasonable profit margin and a desirable position in the competitive market, but achieving these goals can be far more complicated in low coal than in high.

Realization of the finished product should not be overlooked since an increase of $0.01 in realization is just as good as a decrease of $0.01 in actual mining costs. Therefore, on the domestic market where most of Princess Elkhorn coal is sold, it is important to sell as much block, egg and stoker sizes as possible and keep the minus ¼-in quantity to a minimum.

Princess Elkhorn has redesigned and rebuilt loading machines to fit seam height. In one extreme case, a loader was rebuilt with a 15-in line and an overall height of 26 in.

Equipment manufacturers finally recognized this need in the field of low-vein equipment and began development of the present-day high-capacity low-vein loaders, such as the Goodman 964, Joy 14BU-10 and Jeffrey 81C.

Through advanced mining techniques, time study analyses and equipment developments the company has been able to show increased productivity each year for the past 9 yr. It is now producing approximately 12 tons per manshift, and in view of the decreasing coal height during this period, this certainly is to be considered a worthwhile achievement. Increased productivity is characteristic of the industry and in general is the reason for the company's stable and competitive coal prices. The ever-present demand for higher productivity has spurred many of our contributions to the development of good low-vein equipment.

Mobile Multiple Shooting with Air in Low Coal, Joe L. McQuade, senior executive vice president, Maust Coal & Coke Corp., Richwood, W. Va.

The reasons for using Airdox rather than permissible explosives at the Tioga mine of Maust Coal & Coke Corp. are:

1. Increase realization on our sales price by increasing the size of coal.

2. Improve the chemical analysis by being able to better clean the coarse coal.

3. Increase the tph through the cleaning plant, giving a saving in labor and tipple time.

4. The introduction of Long-Airdox drilling and multiple shooting and the means to accomplish both drilling and shooting with one man within the fast time cycle needed in today's high-capacity mining.

This unit is a mobile carrier for the Airdox equipment which provides an easy, safe and extremely fast method of face drilling and shooting. In addition, it provides all the advantages of shooting with air within the time allotted in today's high-capacity mining.

The average time required for the complete drilling and shooting cycle is 17.14 min and breaks down, in minutes, as follows:

Tramming into place (average distance 100 ft)	0.65
Drilling and positioning machine for 10 holes	6.89
Removing tubes from machine and loading lower holes	2.55
Walk to blowdown valve	0.52
Shoot five lower holes	1.25
Return to face and insert tubes in upper holes	1.31
Walk to blowdown valve	0.52
Shoot five upper holes	1.25
Return to face and load tubes and hose on machine	2.10

This fast drilling-shooting cycle compares to a cycle time of 32 min when single shooting.

Maintenance at Moss No. 3 Mine, Ballard Taylor, assistant superintendent of maintenance, Clinchfield Coal Co., Dante, Va.

The four cardinal principles which are deemed most neccessary for a successful maintenance program are:

1. Lubrication. From the time a new piece of equipment is received the first concern is to see that it gets the proper amount of lubrication—and keeps getting it.

2. Care of equipment. By this is meant that the machinery is not subjected to unnecessary roughness or abuse.

3. Employ foremen with know-how and good mechanics with proper tools.

4. Support and cooperation of the top management.

Without any one of these four ingredients the maintenance program will be a failure.

The preventive maintenance crew at Moss No. 3 consists of five mechanics and a foreman. Every fourth day all equipment of a regular production unit is made available to this staff of repairmen for a thorough and systematic check. This production unit is made available by transferring or rotating the regular crew to a spare section.

On-the-spot or breakdown maintenance is handled in two ways. At two of the four portals are located an underground central shop. This station is staffed by four mechanics and a foreman. At the other two portals a mechanic is placed on the section with the regular production crew.

A system of maintenance records has been established. This method provides an accurate daily, weekly, monthly and yearly record on all of the downtime for each piece of equipment in the mine.

The Future of Conventional Equipment, Jack Matheson, chief methods engineer, Island Creek Coal Co., Holden, W. Va.

The future of conventional equipment is excellent and is probably expanding. This does not mean that continuous miners do not have a place in industry and that they will be replaced. Continuous miners do have a definite application and when manufacturers provide continuous haulage to complete the job, the use of miners will probably surge again.

One of the most important factors to be considered and analyzed for comparative purposes is the potential productive capacity of the various types of equipment. Experience at Island Creek Coal Co., has indicated the success of a continuous miner depends, to a great extent, on roof conditions. When the roof is of such nature that it requires support before the miner has advanced a breakthrough length, the tonnage potential of the miner is sharply reduced.

In addition to the time consumed by tramming, a miner also encounters a delay caused by the pickup loader operating behind the miner. It is necessary for the loader to load all of the coal behind the miner before it can be trammed to the next place to be mined, thereby detaining the miner until this cleanup is completed.

Considerations must be given to breakdowns. Any delay to the pick-up loader or continuous miner brings production to an immediate stop. Two operations are involved in producing coal on a continuous miner section. Any delay to either of these operations will result in a loss of production.

Comparing a continuous miner section with a section of conventional equipment, five operations are normally necessary to produce coal on a conventional equipment section. Generally speaking, with conventional equipment, either roof bolting, cutting, drilling or shooting will become a bottleneck to the maximum potential of the loading machine. Theoretically, when a delay is incurred by the loader, all of this time is not lost production. Since a bottleneck probably exists in the preparation cycle, a percentage of the shift will be lost waiting on coal to be prepared and if the loader is down, the preparation cycle continues.

Island Creek recently re-equipped two of its mines with conventional equipment, the installation being completed during the latter part of 1959. Crews were operating at an average tonnage level of 422 tons in 1959. With the installation of the new equipment, this average shows a steady increase. Peak tonnages for individual sections are:

Peak shift	1,593
Peak week	1,238
Peak month	1,169

Cost Control

Profitable Control of Production and Transportation Through Operations Research, David B. Hertz (speaker) and Norman O. Olson, partners, Arthur Andersen & Co., St. Louis, Mo.

Linear programming can be adapted to many problems which are faced by coal operators every day. Among these are (1) development of more mines, (2) market diversification, (3) more customer restrictions, (4) position of reserves, (5) dedication of mines to particular plants or customers, etc. Practical techniques of operations research are applicable to most mines regardless of size. Each operator should consider whether the information on which he bases decisions (and the manner in which it is organized) is adequate to face the challenges of competition and to realize the potential which exists for coal producers, customers and suppliers.

Techniques of operations research provide excellent assistance in more fully accomplishing company objectives.

Predicting Performance of Continuous Miner Operators, John Osmanski (speaker), manager of personnel, Island Creek Coal Co., Huntington, W. Va.; Harold Durrett, Hanna Coal Co., Moundsville, W. Va., and Myles E. Altimus, U. S. Steel Corp., Uniontown, Pa.

In hand-loading days it was claimed that the difference between a good hand loader and a poor one was about 10 tons. The difference between a good cutter operator and a poor one can be as much as 50 tons. A good continuous miner operator can excel over a poor operator by as much as 100 tons per shift.

Consequently, mine management must take care in the selection of continuous miner operators. Boredom is one of the

factors that may contribute to poor performance. Other important factors are certain characteristics like coordination, mechanical aptitude, age and so on. To investigate these possibilities, a sub-committee of the Mechanical Mining Committee of AMC was directed to launch a study of the matter.

In summary, the typical successful miner operator is not necessarily an "old timer" in mining, not necessarily a former operator of cutter, loader or bolter, not necessarily proficient in perceiving space relationships or physical or mechanical concepts, not necessarily a high school graduate, not heavy, but probably tall and probably well coordinated.

Control of Supply Costs Through Inventory Control, W. J. Eck, general manager, Purchasing & Stores Dept., Chesapeake & Ohio Railway Co., Cleveland, Ohio.

The purchasing function is gaining recognition as an area in which substantial contributions to profit can be made.

It is necessary, however, to conduct a continuing program of probing into costs and to make periodic reviews to test the efficiency of the purchasing department's stewardship. Such a program requires more than a personal urge in the department head; others in the organization must be sold on the idea.

C&O has conducted a survey of purchasing and warehousing practices, covering the 500-mi system. Findings of the survey showed that savings could be made in paperwork, procurement and inventory-and-distribution. An equitable balance among all factors was achieved through the development of a cycle-ordering-basis system.

On one side of the balance is the cost of processing orders and maintaining inventory. On the other side is the value of the company's money. The object is to divert a maximum of the company's money from inventory tie-up to capital improvement or other uses. The survey findings were used to prepare tables showing the optimum frequency of ordering supplies, based on the dollar value of those supplies. "Blanket" orders for purchasing were then issued to reduce paperwork. This is the cycle-ordering basis.

Continuing analysis of purchasing practices has clarified the "make or buy" decisions which face management. In a majority of instances it was found advantageous to buy from a source specializing in the commodity.

A survey of this kind should not be fill-in work. It should be undertaken with vigor and concluded on a definite schedule.

Saving Money Through Modern Purchasing and Inventory Control. R. A. Dodds, director of purchases, Truax-Traer Coal Co., Chicago, Ill.

Acquisition of new properties in the early '50's. leading to a rapid increase in Truax-Traer's producing capacity, brought about changes in a great many of the management functions. One of the changes was the formation of a central purchasing department. Purchasing and inventory control formerly were handled by operating divisions.

The cooperation of top management and mine management was required and forthcoming in the successful change to centralized purchasing. One of the results of the change is a 13% reduction in inventory value in the period from January, 1954 to January, 1961. This figure involves only properties operating on both dates and reflects constant price increases by employing the BLS index for finished steel products.

The number of purchasing and warehousing employees has been reduced from 21 in late 1953 to 9 in March, 1961. This reduction was achieved primarily through relieving mine warehouses of purchasing and inventory control responsibilities and streamlining methods for requisitioning supplies through the purchasing department. New forms were developed to serve as requisition from mine to central purchasing and as order blanks, thus eliminating much duplication of effort. Copies of requisitions are sent to the mechanical superintendent or chief preparation engineer, since they are familiar with inventories at all properties. This is helpful in control of overall company inventory.

Strip Mining

Inclined Drilling and Blasting, B. J. Kochanowsky, Department of Mining, Pennsylvania State University, University Park, Pa.

Some of the benefits gained from using the inclined drilling method are:

1. Operations for men and shovels will be safer.

2. Higher benches may be blasted and the number of haulage levels reduced.

3. Toe problems can be eliminated.

4. Better fragmentation will occur because of (a) better utilization of explosive energy, and reduced rock resistance against blasting at the bottom of the bench and (b) reduced rock volume around the stemmed part of the hole at the top of the bench.

5. Difficulties caused by back break in using vertical holes can be eliminated.

6. There will be less footage per ton of rock and reduced explosive consumption because greater burden or spacing are possible.

7. Smaller holes can be used.

8. Tonnage per linear foot of bench will increase.

9. Starting or ending stripping operations will be easier.

10. It is easier to drill the lower bench in surface mining because the damage to rock around the subdrilled area is smaller.

Economics of Large v. Small Haulage Units, E. F. Eckhardt, manager of coal mining, American Electric Power Service Corp., New York, N. Y.

Central Ohio Coal Co. has been operating in the Meigs Creek No. 9 and Ohio No. 6 seams, using the contour method of strip mining. Since the company's inception, about 15 yr ago, approximately 110,000,000 ton-miles of truck haulage has taken place using units which ranged from 20 to 70 tons. Average operating cost has been 4.7¢ per ton-mile.

During the period 1947 to 1953 Central Ohio increased their haulage units 120%, ton-miles haulded 430% and cost per ton-mile 10%. However, after 1953 the number of haulage units, having a much larger capacity, increased approximately 310%, ton-miles 1,670% and the cost per ton-mile decreased 14.5%, not forgetting that labor and supplies have substantially increased during this period.

Since 1953 there were many interesting but non-conclusive facts and figures presented which showed that when comparing cost per ton-mile of 40-ton and larger units with 20-ton units at Central Ohio, labor and maintenance cost decreased 40%, operating and maintenance supplies decreased 21%, and fuel oil 25%, while tire cost increased 40%.

In conclusion, larger haulage units, 40 tons and over, have proven to be the most economical method of transporting coal at Central Ohio. But when looking in the future with a maximum haul of 15 mi or more, we can see the possibility of truck trains and conveyors replacing larger haulage units.

Combination Truck and Belt Haulage, R. S. Humphreys, chief engineer, Stonefort Coal Mining Co., Inc., Indianapolis, Ind.

Stonefort has had more than 7 yr experience with a combination truck and belt haulage system at its Will Scarlet mine in southern Illinois. This system includes trucks which are loaded in the pit and driven to a semi-portable hopper near the pit entrance. Raw coal feeds at the rate of 650 tph onto a 36-in belt traveling at 450 fpm. Near the preparation plant the coal transfers onto an inclined 36-in conveyor, which discharges into a spiral lowering chute feeding a 5,000-ton storage pile.

A comparison of the combination system with truck haulage with 50-ton units shows a slight saving by using the combination. Operating and repairs for the trucks and belt in the combination system were nearly equal to that of all-truck haulage. The savings were effected in decreased road maintenance, but these were partially offset by the higher depreciation for the combination system.

If the mine can be laid out in quadrants with the preparation plant near the center, belt haulage could be considered feasible. A belt could be extended to work out one quadrant, then at the proper time a new belt could be started in a new direction into another quadrant. Timing of the changing of belts is critical.

Two portable hoppers must be available for the leap-frogging required and their size must be kept to a minimum for ease of installing and moving. Size of hopper also affects the size of truck units.

When it is necessary to cross highways, the belt can be taken under or over, eliminating the need for crossing watchmen and the need for trucks to slow down or stop at the intersection.

Interconnection of Hoist and Crowd Controls—A Step Toward Shovel Automation, A. M. Vance, Mining, Petroleum and Chemical Section, Westinghouse Electric Corp., East Pittsburgh, Pa.

It has been stated the difference in efficiency between two shovel operators might be as much as 40%. It is necessary to reduce this difference by supplying a simpler, easier coordinated and less fatiguing type of apparatus to allow an operator to move more overburden or load more coal within a given time.

One aid that has been investigated is the use of television to determine when the bucket is full. The biggest problem is how to evaluate an operator's ability to change from looking at a small TV screen to the large bucket and then make a coordinated decision as to what changes to make in the shovel movement.

The first step in the evolution of control improvement was the addition of the Magamp magnetic amplifier to amplify the current signal into the rotating regulator. The next step was the introduction of the Magamp as the primary regulator.

On the latest loader-size shovel a further improved control system, all-static control, is being employed. The first stage of this control consists of a Magamp in conjunction with transistors to provide a firing circuit for the second stage amplifier. The Magamp is used as a computer to integrate the various signals such as the operator's signal from the stepless master switch, the voltage or current feedback and the current-limit signal to produce an output for the desired production and protection of the electrical equipment. The Magamp in conjunction with the transistors and other semi-conductor units provides a positive pulsed firing circuit to trigger the second-stage power amplifiers for all conditions of master switch output and equipment protection.

The second stage of the control is a static power amplifier which consists principally of the Transitron-controlled rectifiers referred to by AIEE standards as a semi-conductor PNP switch. This semi-conductor in conjunction with protective diodes is assembled on a heat sink. A combination of these assemblies will provide the control system with a very high gain push-pull power amplifier.

Application and Performance of Wheel Excavators, Henry Rumfelt, application engineer, Bucyrus-Erie Co., S. Milwaukee Wis.

There are two types of wheel excavators of interest to the strip miner. One is the large type developed primarily for the brown coal industry in Germany; the other is the type developed mostly in the coal strip mines in Fulton County, Illinois, usually referred to as the Kolbe wheel excavator.

The domestic machines are used exclusively in overburden excavation whereas the German machines may be used in either overburden removal or in coal reclamation.

The philosophy behind the German wheel excavator operation and that behind the domestic stripping operations where wheel excavators are used are quite different. The German procedure, despite comparatively favorable overburden to coal ratios, usually involves deeper workings, thicker coal seams, and wider pit opening, which means that stripping by simple overcasting generally is not feasible.

The domestic practice usually involves larger overburden to coal ratios and the objective is to operate the pits to lesser depths, to reclaim relatively thin coal under an overburden of more varied and more difficult digging characteristics. Very low unit stripping costs are essential, therefore efforts are concentrated on digging the overburden and putting it away in one simple operation if possible. Larger-capacity single units are preferred but in cases where other factors, such as slope stability become a criterion, then tandem operations involving the Kolbe wheel become attractive. To determine the economic possibilities of any newly proposed application requires the evaluation of every pertinent facet of the work in an imaginary model of the proposed operation. One prime consideration, however, which seems almost self evident concerns the nature of the material. It must be economically diggable and once dug it must be efficiently and economically transportable on a conveyor system.

Auger Coal Mining for Profit, Louis F. Zager, management engineer, Helmick & Associates, Cleveland, Ohio.

Auger coal mining can be subdivided into two types of operations: (1) augering of highwalls prepared or left by stripping; and (2) augering of outcrop coal.

Auger mining results in a profitable operation if the following items are considered in the planning stage and during operation:

1. The coal should lay relatively flat or pitch at a constant angle and be free of rolls and faults.

2. The seam may have impurities, but wide or excessively hard horizontal bands of abrasive material will cause excessive bit wear or breakage.

3. Coal quality should be predetermined.

4. Potential market should be determined to establish a basis for capital expenditures.

5. Facing up or benching to provide a solid footing and good drainage.

6. Use an auger that will remove as much of the coal height as possible

7. Pillars of 4 to 12 in thickness should be left between holes.

8. Roads should be laid out for easy maintenance and drainage.

9. Highwalls should be inspected daily for potential slides.

10. Haulage capacity must be large enough for optimum production.

11. Adequate supervision must be provided.

12. Standard operating practices should be established and enforced.

Horizontal Air Drilling, N. O. Lewis, chief engineer, Robbins Machine & Mfg. Co., Inc., Oneota, Ala.

The advantages of horizontal drilling are numerous. The drilling equipment works from and traverses on the pit floor, which provides a stable and relatively consistent foundation. This eliminates the costly, time-consuming road and preparation work required by vertical drills working along the highwall. It also eliminates the down time resulting form miring in soft ground.

There are two major methods of horizontal drilling: auger drilling without air; and rotary drilling with air.

In auger drilling without air, flights on the drill steel are used to remove the cuttings from the hole. A claw or drag-type bit is used to cut the material.

In rotary drilling with air a smooth drill steel or drill pipe is used. Compressed air flowing through the drill steel is exhausted through the bit, blowing the chips from the hole at high speed. The same rotary-type bits as used on the vertical rotary drills are used to chip the material.

The twin-head, or dual-mast, horizontal rotary drill working at the Power mine, Peabody Coal Co., Montrose, Mo., although capable of drilling 12-in holes, is now drilling 6¾-in holes in hard shale with pyrite inclusions. And a layer of limestone is often encountered. Production of over 2,000 ft of hole in one regular shift is not unusual in this formation. Average penetration is about 360 ft of hole per hour.

The drill weighs about 300,000 lb, has a drilling torque of 80,000 in-lb at speeds ranging from 40 to 120 rpm, is provided with constant-torque 75-hp electric motors. Drill heads will move forward at a maximum speed of 60 fpm and retract at 120 fpm. Three 30-ft drill steels are carried in each mast and are handled with the aid of semi-automatic controls located in the control cab. Semi-automatic or automatic handling of drill pipe sections is necessary on any type of high-capacity equipment if high production is to be realized. A full description of the twin-head drill appeared in *Coal Age*, January, 1961, p 78.

Increasing Equipment Availability Through Maintenance, Thomas P. Bradford, lubrication engineer, Hanna Coal Co., Cadiz, Ohio.

It is our belief that we must first start with the manufacturer or his distributor when establishing a good maintenance program. We have decreased our availability, if we purchase equipment having a recognized weakness in basic design, relative to the intended application.

The same is true if we purchase equipment with time consuming replacement problems incorporated in the basic design, or we have an inadequate distributor and/or manufacturer parts and service program. Similarly, we decrease availability if we attempt to operate equipment at a production rate which is overrated by the manufacturer, or in an improper application recommended by the manufacturer.

Preventive maintenance is the key to the success or failure of any operation and maintenance program. It originates with the manufacturer and distributor. The customer must evaluate his average need and expected result, prior to his purchase. We must recognize, evaluate and correct all factors, relative to our objective in any good maintenance program.

The primary function of a good preventive maintenance program is attending to maintenance details at the proper time. However, because of the apparent complexity of attending to a mass of details, we often substitute wishful thinking in place of the preventive maintenance program.

Haulage and Power

The Silicon Rectifier—A New Power Conversion Unit for the Mining Industry, John A. Dunn, chief electrical engineer, Island Creek Coal Co., Holden, W. Va.

"It is my opinion that the silicon rectifier is the most desirable means of converting AC to DC for applications in and around coal mines. These rectifiers can be furnished in just about any output rating from 1 kw up. Low capacity rectifiers of this type can be used in AC-powered mining for operating battery-charging equipment and supplying power for variable-speed motors. It is possible that silicon rectifiers, due to their small size, can be utilized on AC-powered mining machines for operating tramming motors and variable-speed drives."

A silicon rectifier was put in service about midyear 1959 at Island Creek's No. 25 mine. This rectifier was supplying DC power to two sections of face equipment, plus haulage locomotives for two sections. The average load was approximately 300 kw with peaks of 500 to 550 kw while haulage locomotives were on the sections. After about 6 mo of operation, two cells in one path blew the fuse. The warning light was observed by maintenance personnel and those two cells were replaced between shifts. In almost 2 yr of continuous operation no other trouble has occured.

Four additional 500-kw units have been installed since. At one mine a synchronous converter failed in service. During the 6 hr required to replace the converter, the silicon rectifier was supplying power for four sections of face equipment. The nominal DC ampere rating of the 500-kw a unit is 1,750 amp. During these 6 hr the load on the rectifier ranged from 2,300 to 2,700 amp continuously without any ill effects.

The Brakeman Car, E. J. Servant Jr., assistant general superintendent, Olga Coal Co., Coalwood, W. Va.

In an effort to speed up transportation, cut maintenance costs and in general make the haulage system more efficient, it was decided to install trolley on all haulageways. New locomotives were bought for the sectional and secondary haulage, replacing battery locomotives. The 40-ton tandem locomotives on hand were converted to standard separable tandem trolley locomotives, eliminating the battery cars.

Upon the installation of the trolley it was found that the desired benefits were generally realized. However, there was one exception. The 40-ton trolley locomotive could not handle 23 loaded cars on air brakes down the 3% grade in the event of failure of dynamic braking, since they did not have the air-braking capacity that had been available when operating with battery trailer cars. It was necessary that the trips be limited to 17 cars.

It was decided to investigate the merits of the Sanford-Day Brakeman car with the idea in mind of using it as an auxiliary or emergency brake in conjunction with the air brake to supplement it in case of failure of the dynamic brake. Also it would be used to aid the dynamic brake down the steepest grades when hauling a large trip.

"Management at Olga feels it has served economically its need for additional locomotive braking capacity without having to purchase costly additional or larger replacement units and without having to resort to undesirable skids or other devices that would reduce the reliability and efficiency of the main haulage system. From the standpoint of safety it can be said that the danger of runaway trips has been virtually eliminated."

Yieldable Mine Arches Solve a Roof Problem, George L. May, division superintentend, Cambria Div., Bethlehem Mines Corp., Ebensburg, Pa.

The application of yieldable steel arches to uncontrollable roof, even with roof bolts, at Bethlehem Steel's Mine No. 32, Revloc, Pa., has proved satisfactory. All known roof-upport methods including conventional cross-bar and post, steel "I" beams, roof bolts and resin infusion were unsuccessful.

Yieldable arches were first used over a year ago and were installed only in straight line entries, cross cuts, etc. Success in these straight-line installatons was outstanding and plans were made to extend their use to intersection work. Bethlehem Steel designed special yieldable arches in graduated size sets for intersection work. These provided the necessary clearance for intersections while still retaining sufficient strength to match the shorter span arches set on the straightways.

Conventional labor cost to clean up and timber the caved area was $38.91 per foot (costs quoted as applied to a 100-lineal ft section of pressure caved entry for each type of support). Material cost was $23.56 per ft making the total cost of labor and material $62.47 per ft.

Yieldable steel arch labor cost for the necessary clean up and completed installation has been $16.73 per ft. Material cost of the arches and other necessary materials has been $25.13 per ft, making the total cost $41.86 per ft.

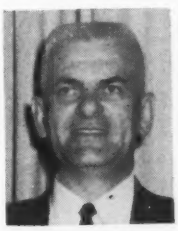
Underground Conveyor Belting in the United Kingdom, S. Weinberg, chief engineer (Specialist Service), National Coal Board, London, England.

The chief interest in this paper is to discuss underground belt haulage in the United Kingdom with respect to the rapid development of polyvinyl chloride (PVC) belts. Originally, the purpose was to satisfy safety requirements in the National Coal Board in regard to fire resistance but which now have mechanical properties superior to those available at the beginning of the development and which are, therefore, producing substantial savings in conveying.

Solid-woven belting, virtually a single complex ply, is intrinsically an expensive construction. With extrapolated life and better fastener-holding properties the value of this belt assumed greater proportions and, for a long time, the best of these belts were the very best belts in use. Some of the recent experimental "premium" ply belts, however, seemed on test to be approaching the qualities of the best solid-woven belts and since they could be made somewhat cheaper, this development looked promising. At present there are at least two belts of ply construction which have given superior performances to those of the best solid woven belts and since they are cheaper, quantities will be purchased for use in the field and to gain further experience.

By the end of 1962 it will be mandatory that no belting which is not fire resistant and safe shall remain underground in the United Kingdom.

Application of Diesel Units Underground, Peter J. Zukow, superintendent, Tennessee Coal & Iron Div., United States Steel Corp., Fairfield, Alabama.



Dieselization is changing our mining picture rather dramatically. Proper recognition must be given to the problems of diesel equipment. The advantages far out weigh the disadvantages. The advantages are:

1. Greater flexibility.
2. Longer length haul due to no cable restriction.
3. Higher speed of travel.
4. Better gradeability.
5. Safety of operation.

Experience with diesel shuttle cars began in June, 1951. These cars, which are still in service, have a two-cycle, direct-injection, 82-hp engine which in turn powers a 50-kw generator. They were designed in accordance with the USBM Schedule 24 for diesels in non-coal mines. The major advantage of this type car is its self-contained power plant.

All the limitations and problems associated with a cable reel were eliminated including restricted length of run and route of travel. The capacity is about 13 tons and the car can attain speeds of about 3 mph on moderate grades up to 8%.

The exhaust conditioning is accomplished with a scrubber. It washes the exhaust gas in a 10% aqueous solution of sodium sulfite inhibited by the addition of 0.5% hydroquinone. It effectively removes the ethelaldehydes and formaldehyde gases from the engine exhaust. The presence of these aldehydes in the exhaust is known to be responsible for the disagreeable odor, and nose and eye irritations that accompany the use of diesel engines.

Coal Preparation

Substitutes for Standard Materials to Reduce Maintenance Costs, V. D. Hanson, mechanical engineer, Consolidation Coal Co., Library, Pa.

Many materials are available to the coal-mining industry that would materially cut costs and improve productive time. It is suggested that a committee of the AMC summarize this data for the coal industry. Among the materials now in use are:

Urethane, a polymer plastic, that can be molded to various shapes. In one application it is used as tires on aerial tram car wheels in a refuse-disposal system. The tires have traveled 20,000 mi with little or no wear.

Monofrax fused cast refractory makes a good chute liner. In one instance a Monofrax-lined chute has handled 4 million tons of coke and is still in excellent condition. Polyethylene chute liners are in use in the anthracite region, and other applications of the material are in truck bodies, coal pockets and conveyor buckets.

Teflon also is being used in chutes and as seals, rings, gaskets, bearings, etc. Flatter chutes are permitted with Teflon because of its low coefficient of friction.

Effect of Continuous Mining Equipment on Cleaning Plant Performance, W. H. Noone, superintendent of preparation, Semet-Solvay Div., Allied Chemical Corp., Montgomery, W. Va.

It is difficult to categorize the effect of continuous mining on coal preparation since it depends so much on the present system of mining. Users of air or gas coal-breaking systems and careful face preparation may be required to make some changes in preparation practices if

a change to continuous mining is made. Others will need to study their own situations with actual test runs. To study the effect of continuous mining on coal preparation means to study its effect on the size and specific gravity fractionation of the plant feed.

The greatest cost may be in loss of efficiency to make the required ash in the slack sizes.

A tentative study outline might be as follows:

1. Complete a size and gravity fractionation of a test section while running present equipment.
2. Complete a similar fractionation with the proposed continuous equipment.
3. Compare size analyses to evaluate effect on fine-coal and water-clarification capacity.
4. Plot projected washer results from distribution functions to compare efficiency at various ash contents that may be desired now or in the future.
5. Compare columnar section analyses with iso-ash, iso-reject and iso-midcoal maps of reserves.

Fine Coal Cleaning With H-M Cyclones, William Benzon, superintendent of preparation, Bethlehem Mines Corp., Johnstown, Pa.

First installation of Dutch State Mines heavy-medium cyclones was made at Century plant, Bethlehem Mines Corp., Buckhannon, W. Va., to clean ⅜x0 which was formerly cleaned by air. The system was installed on the strength of encouraging results of pilot tests on the Redstone-seam coal which was to be cleaned. The larger sizes are washed in hydroseparators. The entire cleaning operation, coarse- and fine-coal, is handled by one operator per shift.

The ⅜x0 is prepared for the cyclones by desliming of minus 28M material on vibrating screens after the material has passed over bent sieves. These steps reduce an original 75 tph to 60 tph of deslimed material for the cyclones.

In air cleaning a product averaging 9% ash was produced. Product of the heavy-medium cyclones averages 5.5% ash. Normal washing gravity is 1.46, although runs have been made as low as 1.31 sp gr.

Estimated life of the cyclones is 124,000 tons, resulting in a cyclone cost of 1.1c per ton. The heavy-medium pump has required some replacement of parts, at a cost of 7.6 mills per ton. Bent sieve costs have amounted to 0.6c per ton, all cost figures based upon 15 mo operation.

The Slack Coal Problem, Roger D. Curfman, fuel agent, Cleveland Electric Illuminating Co., Cleveland, Ohio.

Because fuel accounts for a major part of the costs of producing and distributing power, utility companies must use a fuel providing the lowest possible Btu cost at the burners, together with a minimum of associated operating and maintenance cost problems. There are several disadvantages in using slack coal as compared with mine-run or larger sizes. Impurities in most eastern seams are more friable than the coal or they oxidize and disintegrate more rapidly than the coal, thus concentrating in the finer sizes. Thermal quality in the finer sizes accordingly is reduced 130-140 Btu per lb for each 1% of noncombustible added. Additionally, increased slagging on the boiler tubes acts as insulation and results in lower heat transfer. Superheater operation is adversely affected, ash handling becomes more of a problem and air-pollution problems may arise.

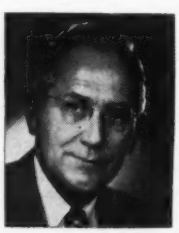
Cost adjustment factors for each 1% change in ash, moisture and/or sulfur have been developed, as follows:

Moisture	0.26%
Ash	0.44%
Sulfur	1.52%

These factors are for one particular plant. They will change with age and design of different plants. In the above, it can be seen that true fuel costs increase 0.26% for each 1% increase in moisture, for example.

Take a new power station that produces 1 Kwh per lb of coal. If the load on this station must be reduced because of high-moisture coal and the load picked up by a station having a rate of 1.5 lb per Kwh, the fuel cost is doubled—$6.50 coal becomes $13.00 coal.

Latest Developments for Continuous Analysis, Loy A. Updegraff, project engineer, Bituminous Coal Research, Inc., Columbus, Ohio.



"Cendrex," a development of Dutch State Mines, is an apparatus for automatic, continuous determination and recording of ash content in a stream of coal by X - ray methods. The system has been under test for 2 yr in Europe, and is soon to be introduced in the U.S. by American Minchem Co. The analyzer is based upon the differential X-ray absorption characteristics of coal and ash. Its recorders are calibrated on the basis of conventional ash analyses.

Other entrants for continuous determination of ash are the nuclear devices —AccuRay, Qualicon and Ohmart devices—which control heavy-medium density to provide constant product quality.

Continuous moisture determination by capacitance methods promise further steps toward full automation of cleaning plants. This is based upon the difference in dielectric properties of coal and moisture. A detector capacitor and a reference capacitor are connected in a bridge circuit, with the detector installed on a belt conveyor, say. Imbalance in the bridge circuit, created by changes in the moisture of the coal with respect to the reference may then by amplified to indicate or record.

Recent Progress in Thermal Drying of Fine Coal, R. E. Zimmerman, vice president, Paul Weir Co., Chicago, Ill.

Ultrafines in the minus ½mm range constitute a very difficult drying problem. Thus far, mechanical methods cannot reduce the moisture to desired levels. There is hope that practical pelletizing methods may be developed to aid in drying ultrafines. In the meantime, fluid-bed dryers have become most popular for this service.

The speaker then described an installation of parallel Buttner units at a washery in Zonguldak, Turkey, in which 28mx0 flotation filter cake is dried. Feed moisture is 30%; product moisture is 5-6%. Heat required is 1,672 Btu per lb of water evaporated.

The installation is highly successful, inasmuch as the washery is situated in the heart of the town, making it vital that exhaust to the atmosphere be clean. These goals were achieved through the use of a series-parallel arrangement of dust collectors.

Planning for Efficient Plant Operation, James B. Girod, assistant general superintendent, Maple Creek Div., Frick Dist., U. S. Steel Corp., Uniontown, Pa.

Among innovations at the Maple Creek plant of U. S. Steel are:

1. Architectural design that blends with surrounding community since the plant is within the town of New Eagle, near homes and school.

2. First application of tubular conveyor galleries, prefabricated in accordance with preliminary plans.

3. Soundproofing of entire plant and certain transportation facilities to eliminate noise from the community.

4. Pipeline transportation of fine refuse and the use of a special refuse shaft for coarse refuse near a well-planned disposal area.

Experience at Maple Creek clearly demonstrates the value of diligent planning upon approaching a project of this scope. The plant has provided trouble-free operation since it was placed on line.

A full description of the Maple Creek plant and mine appears in the June, 1960, issue of *Coal Age*, beginning on p 94.

Processing and Disposal of Coal Flotation Tailings, Dr. D. A. Dahlstrom, vice president, and director of research and development center, Eimco Corp., Palatine, Ill.

Flotation tailings are very high in ash, low in solids and highly dispersed. Requirements for a tailings handling system are (1) a clean effluent, (2) thickened solids for subsequent handling, (3) flexibility in the system, (4) lowest possible cost for installation and operation and (5) low labor requirements.

Flocculation must be considered in view of the dispersion resulting from the action of flotation reagents. Also, upward flow rate in thickeners must be controlled for best clarification. A rate of 0.5 gpm per sq ft of thickener area is about maximum.

Difficulty of filtration increases with an increase in ultrafines. It is suggested that drum-type filters perform better than disk-type when the tailings contain a high proportion of minus 325m material. One step now in use in the industry is to provide a second flocculant feed at the filtering step as well as at thickening.

Safety

Human Engineering in Safety, C. G. Evans, personnel manager, The North American Coal Corp., Cleveland, Ohio.

In industrial psychology the term "human engineering" is defined as the adaption of human beings to the operation of machines. Therefore, human engineering deals primarily with a thorough knowledge of human behavior, taking into consideration man's limitations, as well as his instinctive reaction to certain circumstances. Accordingly, the necessity to design controls to provide the maximum safety and efficiency is ever present.

One company has already designed a set of controls for remote control of a continuous miner to move the machine if the top becomes bad. Why, then, does an operator in, for instance, low coal have to sit or stand cramped in an unnatural position to operate the machine? He could just as well have remote controls where he could see what the cutting heads are doing instead of being located at the back of the machine where he has to have a helper tell him which way to go. Convention says the controls must be on the machine, so that is where they are placed.

Summary of man-machine-relationship needs are:

1. A better work simplification program.

2. Better design of machines for maneuverability.

3. Better design of machines from a standpoint of working conditions for the operator.

4. More attention to mining plans.

5. Exhaustive research in roof control for the protection of people and for higher efficiency of equipment.

Human engineering also includes the responsibility of the engineer to educate management on the problems and objectives of a safety program.

Benefits of a Sound Safety Program, C. O. Kane, manager, Coal Mines, Armco Steel Corp., Montcoal, W. Va. (Paper presented by Mr. Carter, assistant to Mr. Kane).

A sound safety program may be broadly defined as one which is persistent and consistent in its application, has stood the test of time and produces satisfactory results. The results of such a program cannot be evaluated entirely on accomplishments of a humanitarian nature, although these are of first importance and the primary reason for the program.

Benefits of an economic nature, and sometimes not readily apparent, are of such magnitude that they should always be properly evaluated in coal-mine safety programs, in operation or contemplated.

A safety program for the coal mines of Armco Steel Corp. was inititated 17 yr ago. During this period the accident frequency rate dropped from 98.98 in 1943 to 3.87 in 1960, with two of the company's operating mines completing the full year in 1960 without a disabling injury.

In the early days of Armco's program the safety engineers' duties consisted largely of inspection, criticism and reporting—without a display of sympathetic understanding of the foreman's problems or a suggested solution.

The company's first progressive step was to clearly designate the duties of the safety engineer and his inspectors as being staff functions. Criticism by the safety people was to be accompanied by a suggested remedy. The safety engineer was also given the assignment of stimulating the program through research, analysis and coaching.

A major step in the formulation of Armco's program was the compilation of a Supervisors' Safety Manual. This covers all phases of the mining operations, surface and underground. It goes beyond general coverages found in state and federal laws and covers preventive measures against commonly known accident causes.

Design of Pillars for Overburden Support, Charles T. Holland, head, Mining Dept., Virginia Polytechnic Institute, Blacksburg, Va.

Supporting cover can be accomplished by two methods: (1) backfilling or (2) leaving coal in place. The objective is to design pillars to support cover without leaving too much coal. Backfilling is too expensive.

A series of slides was presented pointing out the advantages and disadvantages of various pillar designs.

Discussion: R. L. Dulaney, safety director, Mountaineer Coal Co. Fairmont, W. Va.

Because the maximum stress on coal pillars occurs at or near the edges of the middle pillars it is of particular importance to keep the number of entries to a minimum. This is especially true in deeper mines with 600 to 1,500 ft or more of cover.

The theoretically ideal design of a set of four or less entries with pillars of about three times the entry width can seldom be used for major development work in deep mines. A compromise design which has shown favorable results in the Pittsburgh seam has seven or eight entries with the two middle pillars about twice the size of the others.

Certain coal seams that do not possess the ability to store great amounts of energy, or where the roof or floor strata are weak, do not tend to bump or burst, even under point-loading conditions. Pillar failure is often the result of floor failure and squeezes are the most serious problems encountered.

Practical Aspects of Controlling an Underground Fire on a Mining Machine, Donald Mitchell, chief, Branch of Dust Explosions, and Edwin M. Murphy, chemical engineer, Experimental Coal Mine, USBM, Bruceton, Pa.

Extinguishing agents and techniques for controlling a fire on a simulated mining machine in an underground mine passageway were investigated at the Bureau's experimental coal mine. Research shows that visibility in the fire area is a primary factor affecting control operations. Considerably less time and less extinguishing agent are required if the fire can be seen and if the control agent can be applied directly onto the burning fuel. Associated with good visibility is closeness of approach. The closer the attack can be made the less time and quantity of agent are required for extinguishment. Approach to the fire and visibility will be hindered by smoke and hot gases backing up against the ventilating current. Use of a transverse brattice about two-thirds of the height of the entry r application of a liquid stream will aid in controlling the smoke. Liquid agents were most effective when applied as fog. However, if the attack must be made from more than 20 ft, high- expansion foam and the solid- or aerated-stream techniques are more practical.

New Operations

Orient Mine No. 5, Thomas L. Garwood, chief engineer, Freeman Coal Mining Corp., West Frankfort, Ill.

Modern mining is to be the key in the design of this mine, i.e., automation as far as possible, concentration as much as practical, processing as up-to-date as the future market indicates and manned by the fewest number of workers.

The location of the shaft bottom is as near the center of the property as combinations of physical and natural conditions permit. At first it had been thought that conventional methods using undercutter, air-shooting and mobile loaders might be the system employed but with 32 yr of experience with twin-boring machines in the mine nearest this location, it was thought necessary that this be tested. Development is now going forward, using this type machine.

Processing will be done in a McNally-Pittsburg designed plant with the coarser sizes treated in dense-medium cells and the smaller coals tabled for final treatment of the mine-run coal. Dewatering and heat dryers will be employed.

Coal will be mined according to design in as near complete recovery as conditions will permit and be carried out of the mining area via belt to an automatic loading station where it will be placed in 15-ton eight-wheel mine cars for transportaton to the bottom. It is planned to used two 20-ton locomotives in tandem to handle these trips.

Thunderbird, W. A. Endicott, general superintendent, Ayrshire Collieries Corp., Indianapolis, Ind.

The Thunderbird mine will produce some 1,300,000 tons of steam coal annually, all to be consumed by the new Breed Station, a 475-kw generating plant of Indiana & Michigan Electric Co. The Thunderbird property consists of a roughly rectangular area of 10,000 acres, approximately 4 mi on a side. There are three mineable seams on the property with an estimated 100,000,000 tons of recoverable coal.

Surface buildings include a 600-tph wet-washing preparation plant, laboratory for fuel analysis, wash house, first-aid and lamp house, compressor station, storage building for bulk supplies, supply slope, hoist building and fan house.

This mine is exhaust ventilated by a 6-ft Jeffrey Aerodyne fan located on the surface at the ventilation slope.

The underground mining plan is the standard midwest panel system with no pillar recovery. Estimated recovery following this plan is 55%.

Originally this mine was to be entirely on off-track conventional AC-powered equipment. Subsequent roof conditions have altered original selection of equipment. Two Lee-Norse, one Colmol and two conventional sections are now in operation.

Sunnyhill No. 9, E. W. Pearson, mine superintendent, Peabody Coal Co., Moxahala, Ohio.

Sunnyhill No. 9 mine strips the Ohio No. 6 or Middle Kittanning seam which averages 46 in in thickness with a 2 in binder. Overburden ranges up to 130 ft. Stripping is accomplished with a 1650 - B 65 - yd shovel, loading with a 150-B 7½-yd shovel and the haulage by four 50-ton Dart units. Drilling is done with a Bucyrus 40-R drill, plus dozers, graders, utility vehicles and affiliated equipment.

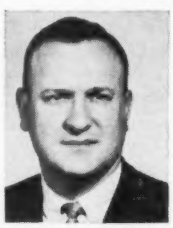
The plant is equipped with a Heyl & Patterson fluid-bed dryer and will handle 480 tph of 1¼-in x 28-M coal. It is capable of reducing the surface moisture from 6% to 2% with a feed of 480 tph.

The plant has four loading tracks and a yard having an empty capacity of 188 cars. Railroad car movements are all controlled by a car-pull operated by one man.

One of the most striking things about the plant itself is the unique siding which is a baked-on plastic process in Peabody's colors. It makes the plant an unusually attractive structure.

Another outstanding feature is the 550-ft-long housed-conveyor running from the plant to the domestic coal yard. Four drop outs, each stockpiling about 1,500 tons, permits stocking four sizes for sale to truckers.

Segco No. 1. Mine, James E. Brown, Jr., manager of coal mine operations, Southern Electric Generating Co.; and G. C. Dyar, vice president, mining operations, Alabama By-Products Corp.



Segco No. 1 mine was opened to supply 1,500,000 tons per year of low-cost fuel to the new Wilsonville generating plant of the Southern Electric Generating Co. It is located in the Warrior Basin in the Alabama coal field in Walker County.

The mine employs a room-and-pillar system of mining. Eight conventional sections produce 8,667 tpd of raw coal in two shifts. Seam reject is 25%. Each operating day provides 6,500 tons of washed coal for shipment. Production crews consist of 12 men, including an electrician and section foreman. The total number of employees on the payroll is 340.

Connections to the surface include a 1,450-ft, 16-deg belt for the coal slope equipped with a 42-in rigidframe belt conveyor 1,660 ft long operating at 600 fpm, and a 42-in gage supply track using 90-lb steel. A second connection is an intake air and manway shaft 20 ft in diameter and 400 ft deep. The third connection is an exhaust air shaft 20 ft in diameter. Two 10-ft diameter axial flow fans are connected to this shaft. One fan is powered by a 400-hp 440-V motor and the other by a 400-hp diesel engine.

From the slope belt transfer house a 42-in stacker conveyor belt stores raw coal in a 12,000-ton pile over a belt

tunnel. The 750-tph capacity preparation plant includes a Baum type jig, four dewatering screens, belt conveyor, drag settling tank, thickener and a railroad car hoist.

Coal-haulage on main and secondary entries is by 42-in belt conveyors 4,000 ft long and operating at 620 fpm. Room entries use 36-in belt conveyors 2,000 ft long operating 365 fpm.

Supplies are handled in special supply cars pulled by DC locomotives to entry turnouts and then transported to the working face by battery-powered tractors and trailers.

AC power is used throughout the mine operation except on inside supply track haulage.

One extra section with complete complement of mining equipment is kept in readiness. For the maintenance cycle one extra machine of each type was purchased.

Continuous Mining

Continuous Mining in Thin Seams, J. L. Marshall, superintendent, Keystone mine, Imperial Coal Corp., Clymer, Pa.

In 1953, Keystone mine was opened in the Kittanning bed. The seam has an undulating bottom with coal thickness running at 39 in or greater in the dip between rolls and averaging 34 in n top of the rolls. Roof is generally good and the floor is comparatively soft fireclay.

Early in 1954 it was recognized that more efficient operation was ‹ sential if the mine was to achieve the desired concentration and increased productivity necessary to compete in the central Pennsylvania field. Subsequently, Colmols were put in operation in 1954, 1955 and 1956. Our experience has shown that the boring-type machine did a good job where 39-in coal was available.

In 1958, when the need for additional equipment arose, an intensive search was made for a lower machine. Observations and discussions led to a decision to experiment with a Lee-Norse LCM28 unit. The early LCM28 differs from the regular model, incorporating two cutter bars with horizontal cutter drums.

Selection of the LCM28 was based on the following: Lower initial capital investment; lower mining height; better product size consist; machine flexibility; ease of maintenance; most practical dimensations for face ventilation during operation; sufficient clearance over machine to timber; maneuverability; and fast tramming speed.

From April, 1959 to August, 1960 the early LCM28 operated and mined coal sufficiently successful under very adverse conditions to make apparent its potential under good conditions. The newest type LCM28 incorporates a gathering head similar to that on all CM miners.

The machine employs a horizontal "clamshell" action and principle of cutting and blocking out coal for proper breaking from the face. Our experience with the application of this principle has shown that better size consist can be obtained with it in thin seams. We determined that the Lee-Norse miner increased the plus ⅜-in material by 19.6%.

Face Ventilation and Dust Control, Boring-Type Continuous Mining Machines, Lancashire No. 15, Mine, John S. Todhunter, general manager, Barnes & Tucker Co., Barnesboro, Pa.

With the adoption of boring-type continuous miners, the concentration of increased output has brought about many of the problems associated with continuous mining, especially those of ventilation. Tests by the USBM and others have shown that high concentrations of methane are easily established under and around boring heads, and with the standard line-brattice system of ventilaton, even with more than adequate air to dilute the gas, it is frequently impossible to remove enough to prevent an explosive mixture about the head.

The installation of an auxiliary diffuser changes in no way the standard system of ventilation with the use of line brattice. The normal flow of air is inby along the runway and outby through line brattice carried on props 4 ft from the rib. Extreme care must be taken in maintaining line brattice with a ventilating unit mounted on the machine.

Dust is now allayed on the Jeffrey Colmol by three water sprays located on the head. About 7½ gpm are required when the machine is mining at the rate of 3 tons per minute.

Field Testing of the Compton CU42 Miner, Norman Yarborough, general manager, Harlan Fuel Co., Yancey, Ky.

Harlan Fuel Co. operates mines in the middle split of the Harlan seam and in the Darby seam at Yancey, Ky. Diminishing reserves in the Harlan seam led the company to open the Darby seam in 1950. At that time very little was known about the characteristics of the Darby seam on Harlan Fuel's property, or its marketability.

A single conventional offtrack unit advanced development headings and coal soon proved equal, or better, than the premium products sold under the "Yancey" tradename. The next major hurdle was mining the coal at a cost that would justify attacking the 6,000 acreas of reserves. Roof control was considered as a major problem. It was believed that continuous mining would improve the roof-control problem. But the size consist of the coal produced by the continuous miner and market conditions had to be considered. Field observations of the Compton CU42 led to the purchase of one for application at Harlan Fuel.

The projected 300 tons per shift has been attained sporadically and the best performance has been 342 tons per shift. A full report on the CU42 miner appeared in the May, 1961, issue of *Coal Age*, p 90.

Maintenance of Continuous Mining Equipment, Arthur Towles, maintenance engineer, Bell & Zoller Coal Co., Johnston City, Ill.

Operating skills, engineering principles and effective maintenance are blended into a smoothly running, efficient operation at Bell & Zoller's Zeigler No. 4 mine, Johnston City, Ill. Effectiveness of the technique is proved by an average output of 75 tons of clean coal per face man on pillaring sections.

The actual maintenance job at Zeigler No. 4 depends to a large extent upon the third-shift maintenance crew.

In the mine foremen's quarters on the surface, we have a large blackboard listing every piece of equipment by number. Adequate space is provided for the dates when each motor brush was checked, gear cases serviced and by whom this work was done.

To facilitate better the movement of repairmen, tools and parts, conventional Jeeps have been converted to battery-powered units. For convenience in recharging these batteries at any point in the mine, chargers have been made an integral part of the unit.

A central shop has proved itself to be a major factor in eliminating costly downtime by doing major overhauls and by incorporating advanced ideas in the improvement of equipment, as well as the building of new equipment. A production line has been initiated since much of the equipment is completely disassembled, steamed cleaned and then returned to the point of reassembly. Trained specialists go over each part before reassembly.

CONTINUOUS MINING—W. A. Hill (left), Maust Coal & Coke Corp.; Robert Wotring, Olga Coal Co.; Wayne Plymale, Eastern Gas & Fuel Associates; N. T. Camicia, Island Creek Coal Co.; Stephen Canonico, Clinchfield Coal Co.; Walter Crickmer, Winding Gulf Coals; and W. H. Laird, Eastern Gas & Fuel Associates.

West Virginia CMI Meets

CONTINUOUS MINING, heavy-medium cyclone washing, bulk handling of rock dust and flame-resistant hydraulic fluids were major topics at the spring meeting of the West Virginia Coal Mining Institute, Mont Chateau Lodge, Morgantown, W. Va., April 21, 22. Some 250 coal executives and manufacturers participated in the three technical sessions.

N. T. Camicia, general manager, Island Creek Coal Co., Holden, W. Va., presided at the Friday morning session and Wayne Plymale, superintendent, Wharton No. 1 mine, Eastern Gas & Fuel Associates, Wharton, W. Va., served as co-chairman. Presiding at the Friday afternoon session was Robert Llewelyn, manager of preparation, Eastern Gas & Fuel Associates, Pittsburgh, Pa. D. H. Davis, vice president, Mountaineer Coal Co., Fairmont, W. Va., was co-chairman. At the Saturday morning session, George McCaa, general manager, Hanna Coal Co., Moundsville, W. Va., served as chairman. John Baugeus, resident engineer, Eastern Gas & Fuels Associates, Keystone, W. Va., was co-chairman.

W. F. Saalbach, personnel supervisor, Research & Development Div., Consolidation Coal Co., Library Pa., spoke at the Friday luncheon on bituminous coal markets—1965, 1970, 1975. At the Friday banquet, Col. W. N. Boaz Jr., USAF, Industrial College of the Armed Forces, Washington, D. C., spoke on public opinion and Dr. Charles E. Lawall, consultant, Huntington, W. Va., presented the Old Timers Award to Philip Mieckle, West Virginia University mining engineering senior.

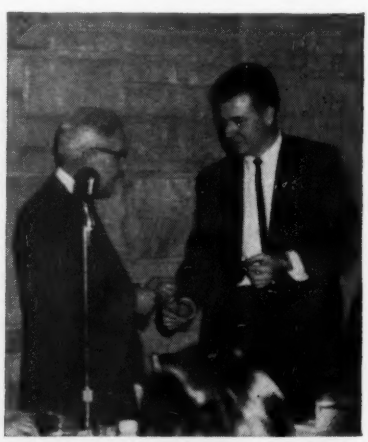
Following are abstracts of all papers.

Report on the Jeffrey 100L Continuous Miner, W. A. Hill, general superintendent, Maust Coal & Coke Corp., Richwood, W. Va.

In 1960 a reevaluation of mining equipment at the Saxeall mine led to the selection of the Jeffrey 100L continuous miners. Located 10 mi from Richwood, W. Va., the mine taps the Sewell seam which is irregular in thickness. Most of the workings are in coal 29 to 31 in thick.

The 100L miner has two auger-type cutting heads which can be raised or lowered to adjust the mining height to

FIRE-RESISTANT FLUIDS, BULK HANDLING—V. D. Hanson (left), Consolidation Coal Co.; David Michael, Hulburt Oil & Grease Co.; J. A. Younkins, Duquesne Light Co.; George McCaa, Hanna Coal Co.; and John Baugeus, Eastern Gas & Fuel.



OLD TIMERS AWARD – Dr. C. E. Lawall (left) presents wristwatch to Philip Mieckle, West Virginia senior.

PREPARATION, CONTINUOUS MINING—W. C. McCulloch (left), Roberts & Schaefer Co.; Earl Boggs, Island Creek Coal Co.; Robert Llewelyn, Eastern Gas & Fuel Associates; D. H. Davis, Mountaineer Coal Co.; Frank DellaGatti, Compton, Inc.; and C. C. Conway, Clackson Div., National Mine Service Co.

the irregular seam. It has operated in 24½-in coal when fitted with 24-in augers and with 20-in augers it can easily mine a 24-in seam. Powered by a single 440-V 50-hp motor, it has a rated capacity of 4 tpm.

In 30-in coal it has produced an average of 36 tons per face man, including time spent handling supplies. These results are achieved with the miner working no more than 60% of the shift time.

Report on Wilcox Continuous Miner Operating at the Winding Gulf Coal Co., Walter Crickmer, assistant to the vice president, Winding Gulf Coals, Inc., Tams, W. Va.

Winding Gulf uses two types of Wilcox continuous miners in recovering the middle split of the Beckley seam which ranges from 26 in to 5 ft in thickness. Average thickness is 34 in. The seam at times is covered with 2 to 12 in of draw-rock, and pitches and rolls.

The mining plan in room panels calls for three headings on 50-ft centers to be driven 24 ft wide to a depth of 2,000 ft. Rooms are driven 30 ft wide on 50-ft centers and pillars are not recovered.

A three-man crew originally was assigned to each continuous miner but capacity of the machine required addition of a fourth worker. One foreman supervises two continuous miner crews and one supplyman delivers supplies to both units with the aid of a Kersey tractor and trailers. Average production with the earlier model Wilcox averaged about 175 tons per miner shift. No increase in the percentage of fines over conventional mining was noted.

The new Mark 20 model is only 20 in high and operates in 24-in coal. It has a 50-hp motor powering each auger, plus a 10- or 15-hp motor driving the main chain conveyor. Capable of mining coal up to 48 in thick, the Mark 20 has produced 530 tons per shift and mines an average of 410 tons. Its chain conveyor has a capacity of 4.8 tpm in handling mined material.

Report on Lee-Norse Continuous Miner Operating at the Olga Coal Co., Robert Wotring, superintendent, Olga No. 2 mine, Olga Coal Co., Coalwood, W. Va.

For the past several years, Olga Coal Co. has been modernizing its Olga No. 2 mine which operates in the Pocahontas No. 4 coal. Lee-Norse continuous miners are employed in both development and pillar work. The latest model is 40 in high, has a 24-in sump, can cut to a height of 8½ ft and is powered by three 50-hp motors.

In pillar work, the face crew includes one foreman, two shuttle car operators, miner operator and two timbermen. In recovering blocks of coal, which are on 90x75-ft centers, the miner operator keeps the face of the lift at 45 deg and keeps it open on the gob side. Blocks are removed one at a time and every effort is made to remove one each shift.

Production has been very good. In one area a crew mined 670 tons in one shift and averaged 426.3 tons. The percentage of recovery has been greater, roof falls have been better and the change to a flat pillar line has helped to eliminate bursts. The percentage of fines produced by continuous miners is about the same as with conventional equipment.

Maintenance is important to prevent production-shift trouble. Two mechanics are employed on each miner on non-producing shifts to handle all repairs and inspection. By concentrating maintenance on the non-producing shifts, downtime has been reduced 6% and the number of maintenance men required on off days has been cut 50%. Operating experience at Olga indicates that the most economical time to rebuild a continuous miner is after it has produced 150,000 tons.

Marietta Continuous Miner, C. C. Conway, assistant general manager, Clarkson Div., National Mine Service Co., Nashville, Ill.

The Marietta continuous miner has been used for 25 yr. Orient No. 3 mine was planned as a completely continuous miner operation and Harry Treadwell took on the task of making a machine for the job. He took the McKinley entry driver and put it on crawlers and the Marietta Mfg. Co. contracted to build it.

The first Marietta miner was installed in Orient No. 3 in 1950 and it is still working well. Two of the machines were used to drive two slopes 3,000 ft.

The Clarkson company purchased the Marietta rights and later the National Mine Service Co. acquired Clarkson and the Marietta miner. Since acquiring the Marietta, National Mine Service has made a number of design changes to improve the unit.

A new-type unit is working under adverse conditions in a trona deposit and has been used successfully in pillar recovery.

An important feature of the new-type machine is easy accessibility of parts for maintenance. The unit has manifolding of the hydraulic system, built-in ammeters and voltmeter. It is available with a total of 250 hp.

Circular Mining With Joy-Compton Continuous Miner, Frank DellaGatti, vice president of engineer, Compton, Inc., Clarksburg, W. Va.

Design of the Joy-Compton miner began on March 1, 1960, and it was operating in December, 1960. The Compton miner cuts an uninterrupted arc with its bits and there is an even load on the bits. It combines weight (55 tons) and horsepower (400) to penetrate the coal.

The miner has a twin barrel-type head and a disk-type tapered cutter at the top which cuts an arched roof. It is 30 ft long, 9 ft wide and 5 ft high. It cuts an opening 13 ft wide and 7 ft high while penetrating coal at the rate of 3 fpm. It trams at speeds up to 30 fpm and can make a 90-deg turn in a 15-ft opening.

Heavy Medium Cyclone Cleaning, Earl Boggs, chief project engineer, Island Creek Coal Co., Holden, W. Va.

Physical conditions in the Bartley No. 1 mine plus market requirements which could not be met with the existing air table installation forced Island Creek to add a more efficient wet-type cleaning plant. Selection of the Roberts & Schaefer heavy-medium cyclone plant was based on two factors:

1. Characteristics of the coal required

a cleaning system with high efficiency.

2. Mining and marketing conditions required quick delivery of the plant.

From the very beginning the cyclone plant has given a very satisfactory cleaning performance, with misplaced material in both the clean coal and refuse falling within the limits set by our contract guarantee (sink in clean coal 4% maximum, float in refuse 10% maximum at 1.40 specific gravity).

Magnetite losses have been consistently high and most of our efforts have been aimed at getting this problem under control. It was soon discovered that the air table method of desliming was unreliable because of wet coal from some areas. Under these conditions, carryover of fines to the cyclone system increased sharply and magnetite loss increased in proportion.

Other factors which we feel have considerable bearing on magnetite loss are the ⅛ in top size of the Bartley coal and the shape and surface fracture of the particles. Both of these conditions make rinsing of magnetite from the clean coal difficult. Furthermore, the ratio of clean coal to refuse under full plant load was not 75 to 25 as anticipated but averages 88 to 12, thus adding to the load on the clean coal screens. As a result, magnetite is being carried out with the clean coal.

We have found that the centrifuges are effective in transferring about 80% of this magnetite from the clean coal into the effluent which goes to plant bleed. Present plans call for the bleed to be pumped to a double-drum magnetic separator for recovery of magnetite. If the separator performs as expected, salvaged magnetite should pay for the installation in 3 to 6 mo.

Labor operating costs are moderate at the Bartley plant. No labor was added when the cyclone plant was put in operation. One man operates the air tables, new cyclone plant and does some cleaning and greasing. Maintenance costs are not expected to be much higher than the average fine-coal wet-washing plant.

A full description of the Bartley No. 1 heavy-medium cyclone plant appeared in *Coal Age*, April, 1961, p 88.

Heavy Medium Cyclone Cleaning, W. C. McCulloch, president, Roberts & Schaefer Co., Chicago, Ill.

Heavy-medium cleaning and froth flotation enable the coal industry to take advantage of the good portion of the coal mined. We have about 2,000 yr of coal reserves in this country and the coal industry can compete by recovering only the good portion and leaving the marginal for the future.

It is possible to recover up to 50% of the coal with 5% or less ash from West Virginia coals with 20 to 30% ash in the raw coal. The good product could be shipped to the coast where competition is keen and the higher ash product could be used nearer to the mine.

Bulk Handling of Rock Dust, V. D. Hanson, mechanical engineer, Consolidation Coal Co., Library, Pa.

Consolidation Coal Co. has had experience with bulk handling of rock dust in Kentucky, West Virginia and Pennsylvania. In handling the rock dust underground, the company employs an Airslide car and a high-speed screw conveyor to fill a distributor carried in a shuttle car.

Bulk handling methods also are used to unload trucks carrying rock dust to the mine. It takes about 3 min to unload a truck when using the bulk handling facilities.

Bulk handling makes it possible to save about $1.50 per ton in the cost of rock dust and there are additional savings made by handling it in bulk in the mine. Total savings are now about $3.00 per ton of rock dust.

Experience With Fire-Resistant Hydraulic Fluid at Harwick Mine, J. A. Younkins, assistant general superintendent, Coal Dept., and M. F. Fowler, safety engineer, Harwick mine, Duquesne Light Co., Pittsburgh, Pa.

The full text of this paper was published in *Coal Age*, October, 1960.

Fire-Resistant Fluids, David H. Michael, general manager, Hulburt Oil & Grease Co., Philadelphia, Pa.

There are three general types of fire-resistant fluids:

1. Synthetic fluids, priced at $3 to $4 per gallon.

2. Water-glycol fluids, priced at $2 to $3 per gallon.

3. Water-in-oil emulsions, priced at 55¢ to $1.50 per gallon.

The price of the first two makes them unacceptable to the mining industry. So it is the third type, water-in-oil emulsion, which is big news.

Advantages of emulsion as compared to conventional petroleum hydraulic oils are:

1. Lowers operating temperatures 10 to 15 deg.

2. More efficient pump operation.

3. Best emulsions can mine coal more efficiently at lower cost.

4. Fire resistant.

Emulsions are slightly less tolerant of malpractices commonly encountered in coal mines, including dirt, foam and temperature.

Emulsions can be bought as a concentrate or pre-mixed and ready to use. Advantages of buying premixed are:

1. No mixing equipment required.

2. No labor or supervision cost.

3. Better mixing, which yields a more stable product.

4. Seller's guarantee.

Emulsions now on the market vary widely in composition and in their characteristics. For example, a typical chemical emulsion tends to freeze in storage, can be inverted, separates water, has a viscosity of 100 to 400 sec, reduces leakage slightly and loses water in service. A mechanical emulsion resists freezing in storage, will not invert, has no water separation, has a viscosity of 1,000 sec, reduces leakage by one-third, holds water content about twice as long as a typical chemical emulsion.

Behind Shepard . . . And Gagarin

Much is made—and rightly so—of the exotic fuels and the missiles and vessels now using them to get up into space with and without men. Perhaps no coal man will ever fire a missile or ride a space satellite, but all coal men can rightly claim a vital part in the growth of these gadgets, because what really makes their construction possible and puts them up into the heavens is plentiful, low-cost energy. That's where the coal man shines, and that's where *Coal Age* finds its opportunity—both "bread-and butter" and "far-out."

Bread-and Butter

Perhaps this term is not the most appropriate for such outstanding case histories as Burning Star in this issue, Imperial Smokeless in May, and Glen Castle coming in June, plus all the others covering the 21 management and supervisory functions in coal mining. Still another July feature is the 1961 *Coal Age* Mining Guidebook, an outstanding example of "bread-and-butter"-type material — supplemented this year with some "look-ahead," an extra reason to be on the watch.

Far-Out

"Far-out" may turn out to be "right here" in coal mining, which is why *Coal Age* this month is running a report on success with diesel shuttle cars in Alabama ore mines . . . and why it regularly discusses such developments as R-C mining, hydraulicking, automated plant operation, etc.

Thus *Coal Age* continues to help with keeping coal low in cost and high in quality, in turn keeping the push behind Shepard and his successors in the days to come.

The right design, the right steel, the right shape make *ESCO* Two Piece Teeth right for every digging condition.

The earth moving industry looks to

ESCO Corporation
PORTLAND, OREGON and DANVILLE, ILLINOIS

See reverse for shapes and size range

Here are the points to remember...

Each easy-to-change ESCO Point is Brinell tested to assure exactly the right degree of shock-absorbing toughness and abrasion-resisting hardness for longer life. Abrasion resistant Wear Caps (illustrated) extend adapter life.

12M ALLOY STEEL

ESCO 12M Two Piece Teeth are the toughest you can use. Developed through years of research for the earth moving industry, cast *ESCO* 12M is the finest steel made for severe shock and abrasion.

ESCO TWO PIECE TEETH
for all your digging equipment

Your *ESCO* dealer can supply two piece teeth for all your equipment. Consult him about standardizing on *ESCO* teeth for the added advantages of quantity purchasing and reduction of on-the-job inventories.

WEAR CAP ADAPTERS

The ESCO Wear Cap Adapter, winner of the Blue Ribbon Mining Award, is the most rugged tooth assembly ever developed for handling tough rock and taconite. Replaceable wear caps sharply increase service life by protecting the adapter from wear. No special pins or welding required.

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FOR EVERY DIGGING CONDITION

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LESS DOWNTIME and MORE RECAPS!

Firestone SUPER ROCK GRIP DEEP TREAD tires help keep your coal trucks working at peak production. With 50% deeper treads of Firestone Rubber-X, they fight off rubble cuts and bruises. This tough tread rubber goes all the way through to the cord to give a long-wearing base for extra money-saving recaps! The Shock-Fortified cord body of bonus-ply nylon guards against impact breaks. Get rugged Firestone tires —plus fast, on-the-job service for all your coal-hauling equipment—from your Firestone Dealer or Store.

Always Specify Firestone Tires When Ordering New Equipment.

Firestone

FIRST IN OFF-THE-HIGHWAY TIRE NEEDS

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QUALITY COAL is effectively washed, dewatered and accurately sized in the company's new preparation plant.

TWO 100-TON RAW-COAL SILOS with feeders supply plant with 200 tph.

OWNERS AND OPERATORS, Johnson Mining Co., are Fon Johnson (center), president; Jimmy D. Johnson, vice president; and B. F. Johnson, secretary and treasurer.

REFUSE FROM WASHER is discharged into a 30-ton storage tank and is conveyed by chain conveyor which discharges directly into truck for disposal.

PREPARED COAL is automatically oiled before it is loaded into railroad cars.

Product planning provides Johnson Mining Co. with . . .

Quality Coal, Better Market Opportunity

NEW PREPARATION FACILITIES of the Johnson Mining Co., Pikeville, Ky., have improved coal quality, resulting in increased market opportunities. Ash content has been reduced from 6% to 3%. Coal quality has improved the sale of coal to the extent that the company is now operating on a steady five-day week compared with a previous two- to three-day week.

The Johnson Mining Co. is located in the heart of the quality Elkhorn seams with an estimated reserve of 10 million tons under lease. Company affiliates include Famous Elkhorn Coal Sales, Inc.; Clark Coal Co., Inc.; Ideal Elkhorn Coal Co., Inc.; and Little Creek Trucking Co., Inc. Central Fuel Corp., Chicago, is exclusive sales agent.

Stoker coal is shipped to Chicago for domestic and industrial consumers. Carbon and egg products are shipped south to power-plant and domestic customers. The plant is served by the C&O R. R.

The Preparation plant was designed by Jeffrey Mfg. Co. and constructed by the mining company's own construction crew. Fon Johnson, president, stated that, "plant-completion date was advanced 2 mo to take advantage of spring markets. This step, plus marketing of a high-quality coal, has placed our company in a very good competitive position."

Preparation Results

	Stoker As Received	Dry Basis
Moisture (%)	4.85	
Ash (%)	2.90	3.00
Volatile (%)	37.91	36.69
Fixed carbon (%)	54.25	56.79
Btu	14,230	14,950

Fusion (Deg. F), 2,406 initial, 2,550 softening, 2,700 fluid.

Coal Flow

Coal is delivered to the plant in trucks and stored in two 100-ton raw-coal bins. Each bin is equipped with a Jeffrey vibratory feeder with adjustable feed up to 200 tph. Raw coal can be fed from either bin or both at any desired ratio.

Feeders discharge onto a 36-in raw-coal belt equipped with a magnetic head roller to remove tramp iron. Coal is then fed onto a 6x16 double-deck Simplicity vibrator. Plus 6-in is crushed to minus 6-in and returned to the 6x16-ft vibrator. All ⅜ x0 coal is removed from the raw-coal feed and conveyed to the loading boom and loaded into railroad cars.

The 6x⅜-in product is flumed to a Jeffrey 200 unit-washer with a two-compartment diaphragm jig. Refuse is elevated to a storage bin and conveyed by a Jeffrey conveyor to trucks.

The 6x⅜ coal is passed over a stationary Bixby-Zimmer screen to dump large quantities of water before discharging onto a triple-deck Jeffrey dewatering and classifying vibrator. Top product, 6x3 egg, is conveyed and loaded into railroad cars.

The 3x1-in coal on the second screen is conveyed to a Jeffrey double-roll crusher and crushed to the proper stoker size. It is then discharged onto a 5x12 double-deck Simplicity vibrator. Oversized product from the top deck is returned to the crusher and the stoker size is retained on the bottom deck. Carbon (⅜x0) from the bottom deck is discharged onto a belt conveyor and loaded into cars.

Coal retained on the bottom deck of the dewatering and classifying screen goes directly to the stoker belt conveyor where it is oil treated and then loaded into railroad cars. Through product from bottom screen goes to a 9x40-ft-long 6-ft-deep settling tank. The ⅜x0 coal is collected and conveyed to a CMI dryer. Dried product is discharged to the carbon belt conveyor for loading. Effluent is pumped to two 8-in cyclones. Underflow is dewatered and conveyed to the railroad loading boom. Over-flow goes to a settling pond.

The three-track plant has track space for 33 loaded railroad cars and 33 empties.

All wiring is in conduit. Plant is an all-steel electrically welded structure and is covered with galvanized corrugated steel.

Water is pumped from a deep well producing 200 gpm to two 10,000 gal tanks.

Stoker spray oil is stored in a 10,000 gal tank.

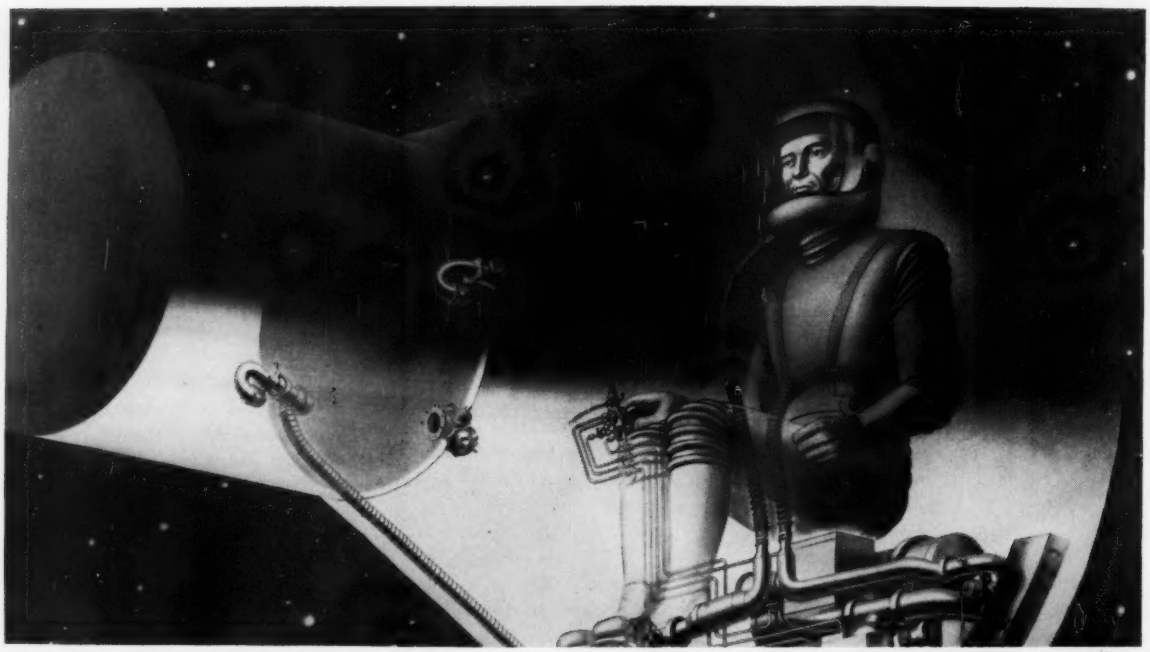
Float and sink tests are made at the washer at least four times daily.

An independent laboratory, Coal Lab Inc., Pikeville, Ky., is employed to take periodic samples of coal to monitor coal quality and also to provide customers with analyses.

Standard sizes produced include 6x3 egg; 1½x⅜, 1¼x⅜, 1x⅜, ⅞x⅜ stoker; ⅜x0; R-O-M; nut; and slack.

TWO-COMPARTMENT JIG (right), reduces ash content from 6% to 3%. Control station and power center (left) are combined for ease of operation and maintenance.

Foremen's Forum



—Garrett Corp.

Lift Off! ...Whoosh...

The man in the Go-Bucket provides the world's greatest example of the value of training. Advance preparation gets him ready to face a hair-raising experience with becoming aplomb and unimpaired effectiveness.

MAKE NO MISTAKE, the astronaut is a special type of man. All seven candidates for the ride which was finally taken by Commander Shepard are highly intelligent and psychologically sound. Through their previous test-pilot training and operations they are accustomed to working effectively in environments that would be unnatural to most of us.

But beyond these sterling attributes the astronaut, even as you and I, must approach a ride through space with strange feelings of awe—and perhaps trepidation. Space is a totally strange environment. That is, before the training program begins.

Commander Shepard and his colleagues for months have been engaged in a rigorous program of physical conditioning. They have spent countless hours studying space technology and the mechanical aspects of ballistics and rocketry. The atmosphere in which they have lived and worked all these months has been filled with the language of space.

They have devoted hours and hours of study and familiarization to the Project Mercury space capsule. They learned more about its operation and makeup than we know about the inner workings of the watches on our wrists. The functions of more than 100 controls had to be memorized—no mistakes tolerated. They had to learn to identify all control knobs, levers, switches, buttons and actuators by sense of touch. Three environmental control systems, one for the space suit, one for the capsule and one for cooling the capsule during re-entry, had to be mastered.

In addition to these academic exercises, the astronauts rode test devices designed to simulate the sensations of weightlessness and gravity-pull that would be encountered. They were centrifuged, spun, rolled, accelerated and decelerated under watchful medical monitoring.

Familiarity with the strange environment of space began to develop, permit-

He's increasing tonnage, cutting costs, saving time! His Sunoco 740-A EP lubricant is teamed with just *one* Sunoco hydraulic oil (job-fitted from a full line of hydraulic oils) to meet all daily lube needs at the face! Sunoco 740-A EP clings like grease, pours like oil. It fights rust, oxidation, has extra film strength to stand up under coal dust. It's more adhesive, too, with better load-carrying capacities. Pioneering of the basic two-product *quality* lube program by Sunoco even sparked development, in conjunction with a leading equipment manufacturer, of the well-known two-output pump shown above. It can be used with a product like 740-A EP to fill gear cases at high *volume* or on pressure fittings at high *pressure*.

What's the difference in 2-product lube programs?

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QUALITY . . .

THE BEST ECONOMY OF ALL

Simply this: with the Sunoco program you are assured the product quality it takes to meet all your daily needs at the face . . . *job-fitted* by men who developed the simplified lube program . . . backed by the service you have a right to expect . . . Call your Sun representative today and get squared away on real savings. Or write to: Sun Oil Company, Philadelphia 3, Pa., Dept. CA-6. In Canada: Sun Oil Company Limited, Toronto and Montreal.

PIONEERING PETROLEUM PROGRESS FOR 75 YEARS

ting the training to be carried into final stages. This latter training was designed to sharpen the ability of the astronauts to perform useful tasks while zooming through the upper reaches of Creation.

The supporting team also had undergone intensive training. The men at the launching controls, the communications experts and trackers, the telemetry specialists and the recovery ships' crews—all arrived at a fine state of proficiency.

Finally the day came when all this training should be crystallized into actual experience. It was May 5. Commander Shepard took his position in the tiny capsule at the top of a dormant thunderbolt. For some hours he was alone while he awaited the big thrust. Many gave voice to the thought, "How can he bring himself to the point of doing this?" Well, this was the payoff on all the training that had gone before.

It is a matter of history now that when the Redstone lifted off, the machinery, the man and the supporting team worked perfectly, in tribute to their desire, their knowledge, their skill and their training.

(If you will permit an aside—we think Commander Shepard's ride was a perfect response to President Kennedy's inaugural plea, "Ask not what your country can do for you; ask what you can do for your country." The flight should remind us that there are throngs of unsung men who are doing good jobs in all callings in good faith.)

Let's bring the discussion closer to home. The underground environment in which many of you work is unnatural for men—or at least unusual. Many people wonder how you can bring yourself to the point of wanting to work underground. This wonderment is voiced especially when the press carries the news of serious accidents or disasters.

How do you feel about this? Let me try to explain how I think you feel. Your first day in the mine is a rather harrowing experience. The environment is strange. In fact it is an alien environment. Clearances are limited in comparison to the room one has on the surface. Sounds are strange, and the odor is a new experience. The machinery growls and has a menacing look about it. Men you have known for years look different in their pit clothes.

However, after a period of indoctrination and orientation you begin to relax. You begin to feel at home in your new environment. You have learned to cope with your new surroundings. Is this not the way you feel?

This, too, is a form of training. You were taught by your supervisors and you learned from your coworkers. Assuming that the mine remained free of any emergency situations, you were now prepared to take your place as an effective miner.

But conditions do not always remain normal. Emergencies do arise which change the environment to something worse than we expect as customary. Effective clearance of these emergencies requires additional training.

Underground conditions that appear frightening to untrained men are accepted for what they are by a trained, experienced mine-rescue team. Panic is born in lack of knowledge; effective emergency action is based in knowledge, preparation and training.

Backing up this effective action by trained men is the supporting team, like the men behind the astronauts. In our business the supporting team includes interested top management, company safety departments, training experts from the Bureau of Mines and state departments, manufacturers of emergency-clearing equipment and others. Comparable to the devices used by the astronauts to simulate the sensations of space travel are the training aids used by the Bureau to duplicate conditions that might be encountered by a mine-rescue team on an actual mission. As a matter of fact, the mine-rescue specialist carries his own environment with him in his breathing apparatus, as the astronaut wears his space suit.

This training does have meaning and value. It is symbolic of other kinds of training that responsible supervisors and mineworkers should pursue. Teams of experts—trained and experienced — are needed in the use of proper fireighting techniques, including conventional methods with water and rock dust and the newer foam plug.

The ability to lead an emergency exodus from a stricken section requires training—and the confidence that comes with training. Proper barricading is a job to be led by a man who can surely answer the questions why, where, how.

One of the necessary attributes of this special kind of man is interest in new developments. You can be certain that space-program research will result in the development of new instruments that might possibly have applications in industry. Some of our highly-refined methane detectors and indicators have their origin in devices developed for other purposes. The point is that these new developments must be studied, and used in practice and tests so that their functioning and employment become thoroughly familiar.

Among other things, training emerges as one of the most important ingredients in the recent suborbital ride. It is equally important in mining.

—*National Safety Council*

June 24—July 8

Now that you're off—and everything at home is taken care of per the countdown above—enjoy the ride to your favorite vacation spot. But play it safe; drive like a reasonable man. The life you save may be one of our readers—you!

Take good care of the youngsters. Limit their exposure to the sun; excessive sunburn is as painful and skin-damaging as any other burn.

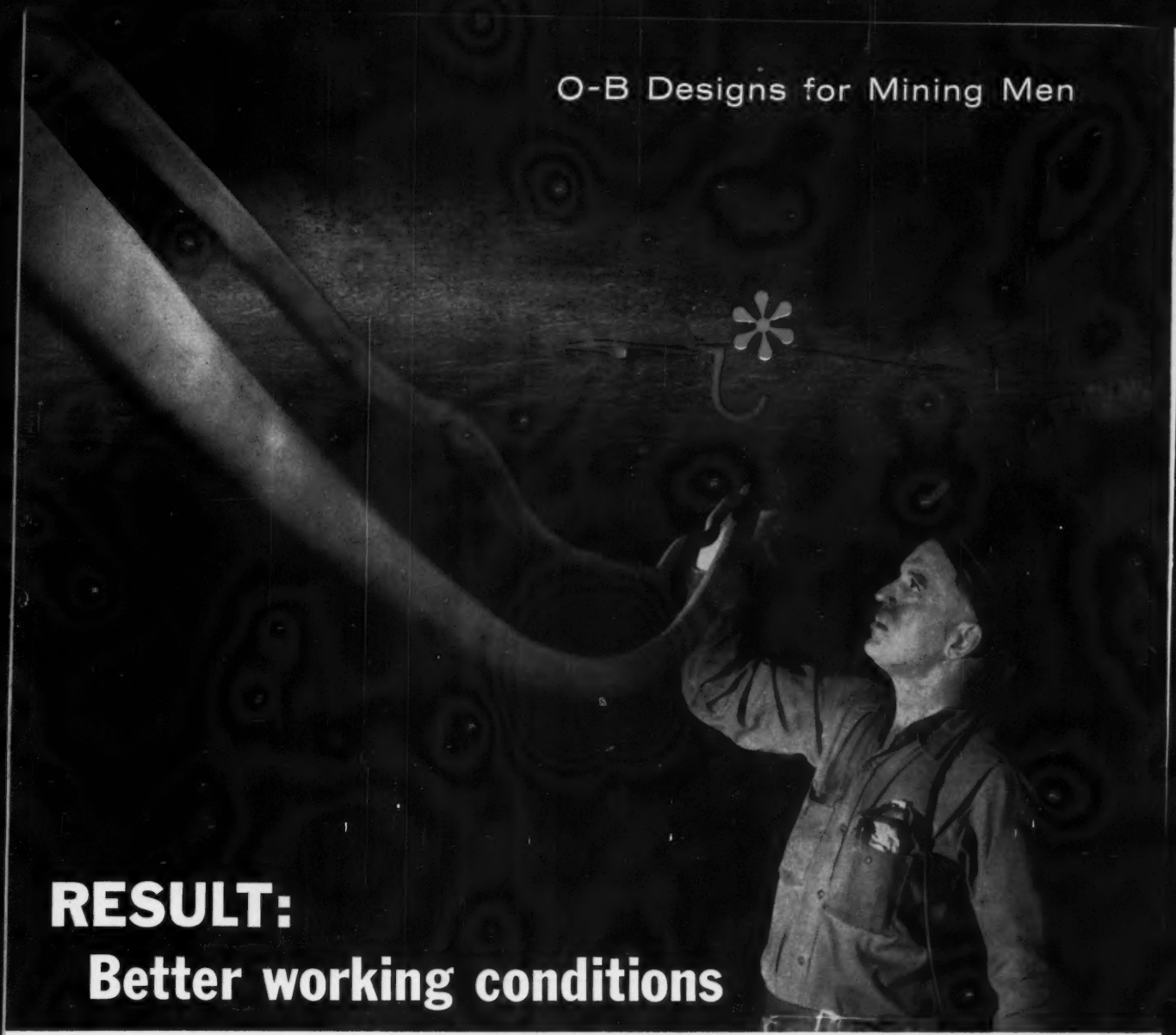
Learn to identify the poisonous plants, ivy, oak and sumach, and review the first-aid procedures to be followed in the event anyone in your group makes contact with these.

Observe water safety rules. Do not dive into strange water without first investigating what obstacles might lie under the surface. Prohibit horseplay in boats. Learn the techniques of mouth-to-mouth resuscitation.

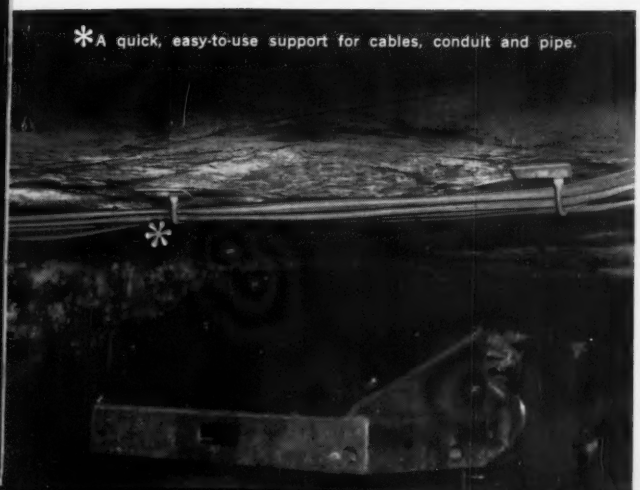
Do not cast plugs, flies or other lures until you have checked your clearance. Youngsters like to stand close to the action, which may lead to hooks in scalps.

Be safe, have fun, and come back with pleasant memories of a refreshing two weeks in the woods or on the roads.

O-B Designs for Mining Men



RESULT:
Better working conditions for men and equipment



*A quick, easy-to-use support for cables, conduit and pipe.

The O-B roof plate hook installs with one hammer blow.

- CLEARS MINE BOTTOM FAST AND EASY . . . cables, conduits and pipe go out of the way overhead leaving a clear way underneath for men and machines.
- PROTECTS ITS LINES FROM DAMAGE . . . saves costs because cables and other such valuable linage are held out of the way of wheels and feet.
- THESE HANDY HELPERS CAN BE USED OVER AND OVER AGAIN . . . once a section has been worked out . . . roof plate hooks can be reclaimed as easily as they were installed. This easy-to-use support moves with your operation! Order them from your O-B representative when he next stops at your mine. O-B Roof Plate hooks will make your mine operation safer and faster.

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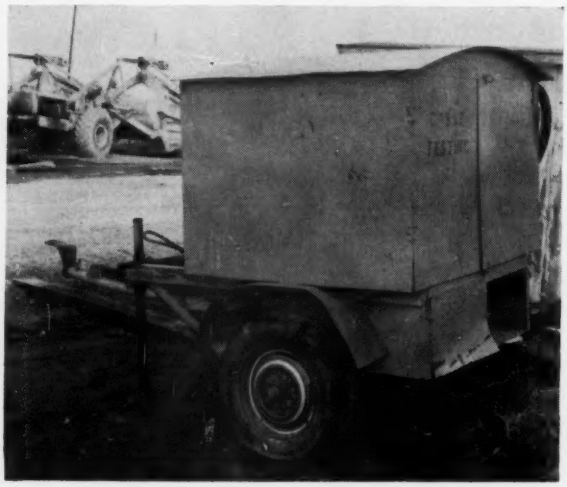
Operating Ideas



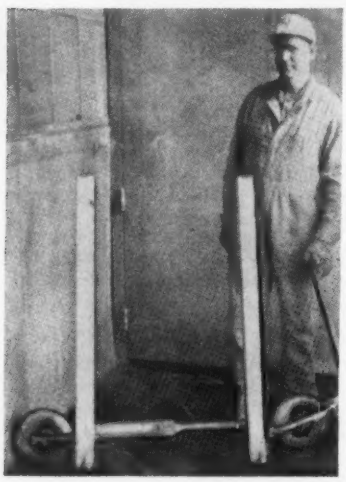
Portable Cable Tester Saves Time and Trouble

SHOP-BUILT TRAILER, carrying cable-testing and fault-finding equipment, was originally put together by Charles Bledsoe, retired Chief Engineer, and is now used under the direction of Hubert E. Davis, master mechanic, Allendale mine, Stonefort Coal Mining Company, Wyoming, Illinois. The benefits are faster location of faults and less cable handling.

The power source may be 4000-V or 110-V AC. The latter may be supplied by a gasoline driven 110-V AC 60-cycle generator. The equipment consists of a IM.F. 20-kv condenser, and a sphere gap. The condenser is charged to a given value by the AC to DC power supply, then discharged across the sphere gap through the fault to ground, causing a distinct snap at the fault.

An analysis may also be made of the condition of a cable after repairs, by use of the steady state DC current, available at the output terminals of the machine.

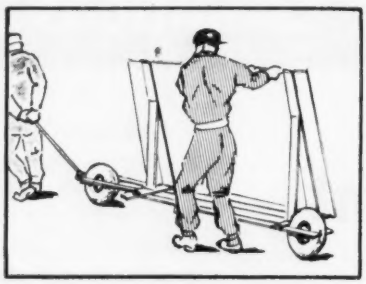
Faults are located by walking along the cable, listening for a discharge snap or report, which occurs about every second, at the fault.

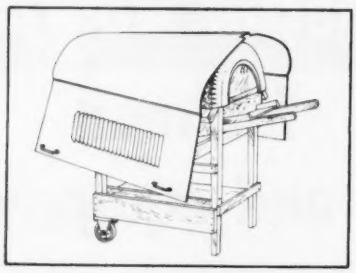


Two-Wheeled Cart Hauls Sheet Iron And Screens Safely

INJURIES to employees while transporting sheet iron or screens have been eliminated at the Kopperston preparation plant, Kopperston, W. Va., according to *The Safe Mine Foreman*, published by the Eastern Gas & Fuel Associates. L. G. Snider, Kopperston tipple foreman, designed a two-wheel cart which is now used to ease the transportation of these heavy and bulky items in the plant. He is shown in the photograph with one of the carts he designed.

The cart has two slightly sloping supports which hold the material as it is transported to the work site. These supports have a minimum of ground clearance so that they can be loaded with a minimum of lifting.





Wheeled Stand Eases Painting

A WHEELED STAND made from scrap lumber and old tire casings eases the job of painting and handling hoods and fenders, according to *Fleet Owner*. Wheels from a junked cargo-handling cart and handles like those on a wheel barrow enable one man to move even heavy, bulky panels without marring newly painted surfaces. Cross pieces nailed to the frame just below the handles hold the hood side panels steady so that a shop man can sand or smooth them more easily.

THE WHEAT SYSTEM

OF CONTINUOUSLY-IMPROVED COMPONENTS

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30% more light . . . finger-tip focussing . . . a perfect spot, every time

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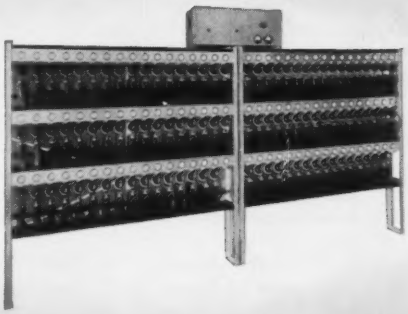
Fully automatic . . . electronically controlled . . . transistorized . . . true self-service



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Engine-Vent Care Reduces Engine Wear

By J. W. Duncan
Supervisor, Service Training, International Harvester Co.

THE CRANKCASE VENTILATION SYSTEM is the most misunderstood and neglected part of an internal combustion engine, reports the service department of International Harvester Co.'s Construction Equipment Div.

When an engine fires, a highly corrosive, acid-base gas forms. Also, a gallon of water is produced for every gallon of fuel burned. Most of these harmful products disappear with the exhaust. But a small percentage of these vapors slips past the piston rings. The volume increases as the rings wear.

Only the crankcase ventilating system can remove these harmful vapors. And they must be dispelled quickly before they condense in the crankcase oil.

On smaller carbureted engines, air usually enters the crankcase through a metallic screen in the oil filler cap. This screen bars foreign material, but must be cleaned in solvent every 2,000 to 4,000 mi to admit properly the required volume of fresh air.

In this type engine, vapor evacuation is accomplished through the road draft tube; the angle cut at the end of the tube creates a partial vacuum, causing the vapors to be forced out by atmospheric pressure. The road draft tube always must be kept open.

Heavy-duty carbureted engines, as a rule, rely on a positive type of crankcase ventilation. Here, the intake manifold draws and burns off fumes from the crankcase and cylinder head.

Clean air enters the crankcase through a hose connected to the cleaner. The volume of air is controlled by a metering valve. A vacuum line on top of the valve is connected to the intake manifold.

To work efficiently, the metering valve must be free in the housing. The unit should be serviced seasonally by disconnecting the manifold vacuum line and removing the valve housing. The two halves of the housing should be separated and solvent-cleaned, together with the weight inside the housing. If the valve is mounted on a 90-deg street elbow, the elbow should be removed and cleaned.

In the case of diesel engines, many of which work under extremely dusty conditions, ventilating air must be filtered before it enters the engine. Diesels use large-capacity breathers, which are usually mounted on the push-rod chamber side plate. The breathers are protected with sheet metal baffles and wire mesh screens to prevent loss of lubricating oil and entry of dirt. If the screens plug up, vapors will condense in the crankcase and the pressure balance within the engine will be upset.

Breathers should be removed after every 250 hr of service and soaked in solvent. Should the packing become damaged, replace it immediately. This operation takes 10 min at the most, but its importance cannot be overstressed.

With expanding use of turbocharged engines, breather maintenance is more important than ever. In a recent case, a turbocharged tractor engine performed perfectly for 1,500 hr. Then the turbo seals began leaking into the exhaust and intake manifolds. A replacement turbo lasted only a few hours before it began to leak. Another replacement fared the same.

When a trained serviceman was called, he found the breather was at fault. It never had been serviced and was plugged tightly.

Why did the plugged breather cause such a turbocharger reaction? The answer is simple. Turbocharger oil seals are the compression type. A pressure balance is required between the air and oil, and between the exhaust gases and oil pressures. If either of these balances is disrupted, the seals will leak, regardless of their condition.

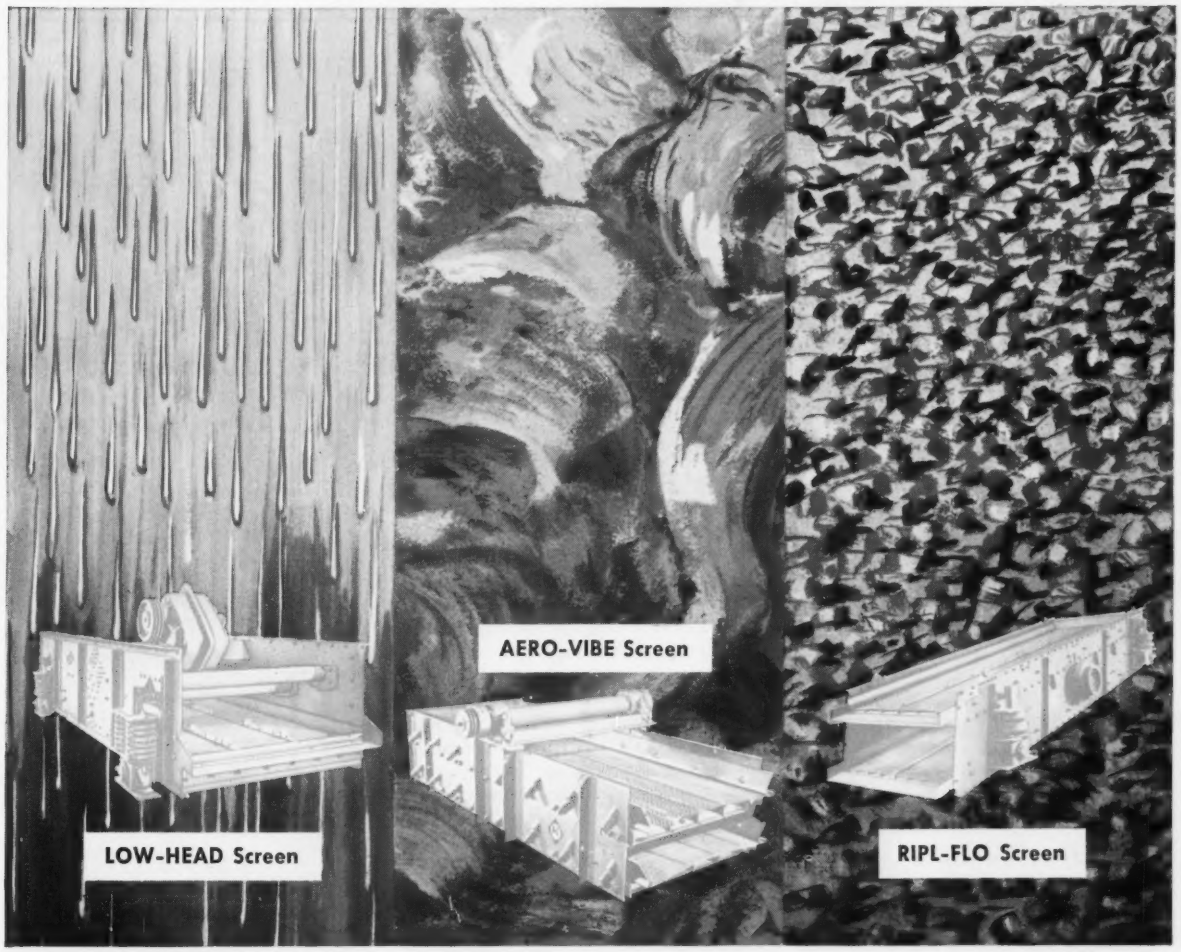
The plugged breather caused excessive pressure in the crankcase. This pressure, looking for an escape route, found it in the turbocharger oil-return line. The back pressure caused the seals to leak.

Air Jets Serve as Belt Cleaner

WHAT TO DO about the black rain falling from the wet-coal feed conveyors to their new drying plant was the problem confronting officials of The Enos Coal Mining Co., Oakland City, Ind. A number of conventional methods of cleaning the belt were tried but the problem persisted.

In the photo, R. A. Mullins, preparation manager at Enos, points to compressed air line leading in under the belt head. The top of the pipe is pierced to direct jets of air onto the belt surface at the beginning of the return run. The idea worked so well in solving the problem that management installed a new compressor to supply belt-cleaning air.

ALLIS-CHALMERS



For scalping, sizing, washing, dewatering, media or solids recovery...

Judge a screen by the job it does

Depend on Allis-Chalmers for a high capacity, low-maintenance, dependable screen to fit your operation exactly. Whether it's for wet or dry process, light or heavy feed, coarse or fine sizing, the right screen for you is the one that is designed to do a specific job.

A-C engineers, working with the industry's most complete line of vibrating screens, are able to evaluate your process without restrictions. Recommendations are completely unbiased... dictated only by your specific needs.

The result? You get a superior screen, more accurately placed in your system. You make existing as well as new equipment as productive and economical as possible.

Ask your A-C representative about the engineering service that stands behind every A-C screen. Or write **Allis-Chalmers,** *Industrial Equipment Division, Milwaukee 1, Wisconsin.* A-1387

LOW-HEAD HORIZONTAL SCREENS

for coarse to fine, wet or dry sizing, washing, draining, dewatering and media recovery. Wire cloth, parallel rod or perforated plate surfaces. Maximum aperture, 2½ inches. 1, 2 or 3 decks.

AVS AERO-VIBE INCLINED SCREENS

for moderate to fine, wet or dry sizing, washing and dewatering. Top screening at lowest price. Available with wire cloth, parallel rod or perforated plate surfaces. Maximum aperture, 1½ inch. 1, 2 or 3 decks.

SH RIPL-FLO INCLINED SCREENS

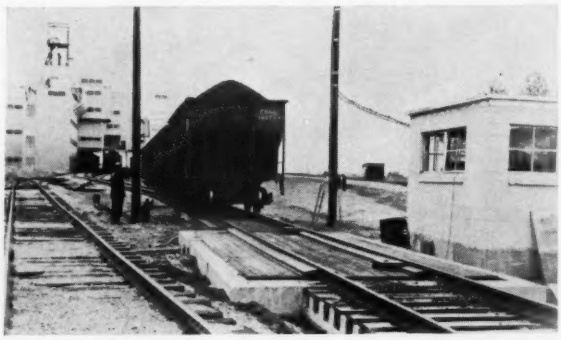
for light scalping, coarse to fine wet or dry sizing and rinsing. Balanced two-bearing mechanism. Wire cloth, perforated plate or parallel rod surfaces. Maximum aperture, 5 inches. 1, 2 or 3 decks.

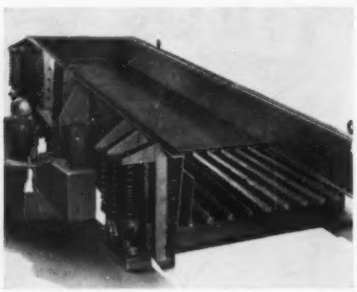
New Equipment News

Rail Cars Weighed in 3 Seconds

A Model Q high-speed weigher, able to balance and print out in less than three seconds as cars roll by on rails, has been introduced by Fairbanks, Morse & Co., Electronics Div., West Hartford, Conn. Exclusive of scale, the Model Q costs from $8,000 to $10,000. It is able to weigh as much as 800,000 lb, by 200-lb increments, or as little as 60 lb, by 1/10-lb increments.

Since vibration was the big foe to overcome in developing this weigher, the company used bonded strain gage load cells. Because these cells have an exceptionally high rate of response, they are quick to pick up vibration frequencies caused by the cars' rolling movements and by flat spots on the car wheels. Where mechanical lever systems were used, lever-damp and cell-damp assemblies which resisted vibration in the load-receiving element were developed. Damp techniques were also applied to the electronic amplifiers to effectively shut off unwanted signals.



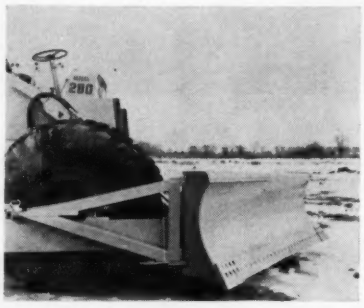


Heavy-Duty Vibrating Feeders

A standard line of Low-Head heavy duty vibrating feeders for controlled conveying and feeding of aggregates is offered by Allis-Chalmers Mfg. Co., 986 S. 70th St., Milwaukee 1, Wis. The new feeder is available at 5- and 10-deg slopes with solid pan deck or partial pan in combination with a grizzly section at the discharge end. This pan and grizzly feeder is particularly suited for removal of fines ahead of crushers or for scalping oversize. The feeder can be supplied with either a standard, high-torque or a variable-speed, wound rotor motor with pivoted base. Widths of 3, 4, 5 and 6-ft and various lengths are available.

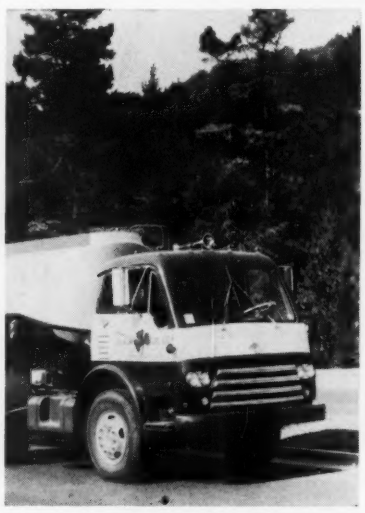
Low-Cost Mine Roof Expansion Unit

A "West Virginia Lokgrip" expansion unit costing only 20c, provides superior mine roof anchorage characteristics, reports Connors Steel Div., H. K. Porter Co., Inc., 5000 Powell Ave., Birmingham, Ala. An outstanding feature is its self-locking design, requiring no Palnut. This reduces installation time considerably and eliminates component losses in the mine. Advantages of the new unit allow a wide range of applications when installed in 1⅜-in-dia holes. "Lokgrip" eliminates radial expansion thrust against threads by a two-piece expansion unit which does not require a retaining ring. "Lokgrip's" shell is formed from shell casing quality steel with a minimum strength of 70,000 lb per sq in. And the unit's plug is a precision malleable-iron casting with a minimum strength of 50,000 lb per sq in.



Angle Blade for Dozers

A new high-strength steel-angle blade for two models of the "Michigan" line of rubber-tired Tractor Dozers has been announced by Construction Machinery Div., Clark Equipment Co., Pipestone Plant, Benton Harbor, Mich. Designed for use on Models 180 and 280—a size for each—the new blade may be angled 25 deg to right or left. And it has its own "C" frame for mounting to the tractor dozer. Maximum blade tilt is 8 in. Model 180 weighs 6,500 lb and Model 280, 8,800 lb, including the "C" frame. Both stand 3 ft 4 in high.



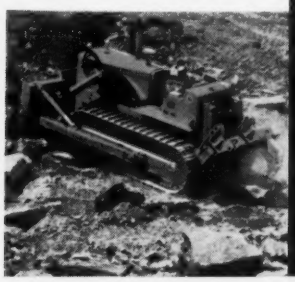
Trucks with Fiberglass Tilt-Cabs

Diamond T Motor Truck Co. is producing two new trucks—Models 738CG and 838CG. Both are powered by the company's wet-sleeve gasoline engines and have tilt-cabs of fiberglass. They are built as six-wheelers with a wide range of tandems in suitable ratios for any service. Ratings go to 70,000 lb gcw.

The fiberglass construction of the tilt-cabs is said to offer many advantages. Fiberglass cannot rust or corrode, is more resilient than steel, is safer, longer-lived, quieter and more comfortable. In addition, these fiberglass cabs weigh almost 350 lb less than the steel cabs formerly used.

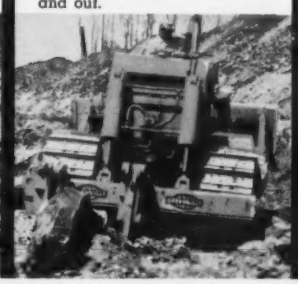
For further information, address the company at 4401 W. 26th St., Chicago 23, Ill.

RIPPER ACCOMMODATES ONE, two or three shanks as needed.



RIPPER RIDES CLEAR when not in use. Unit does not limit other tractor uses.

SOCKED TO FULL DEPTH, ripper utilizes tremendous power of TD-25. Rocks pry up and out.



RIPPER WEIGHT balances 'dozer, resulting in greater traction and more usable horsepower.

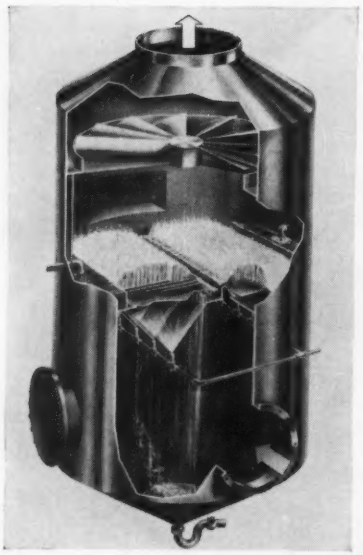
SLASH STRIP COSTS

Rugged Greenville Rippers mounted on International TD-15, TD-20 or TD-25 tractors get you down to the seam faster and often eliminate the need for explosives. You rip overburden free and push it directly onto the spoil bank.

In auger mines your tractor is completely equipped for face-up, pit preparation and road maintenance. Write for Bulletin GR-760 today. It gives complete data on Greenville Rippers and accessories.

GREENVILLE STEEL CAR COMPANY

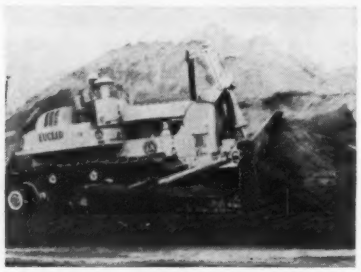
GREENVILLE, PENNSYLVANIA



Impingement-Plate Scrubbers

Impingement-plate-type scubbers for wet cleaning, absorption or cooling of gases are being marketed by W. W. Sly Mfg. Co., 4700 Train Ave., Cleveland 1, Ohio. The Sly "Impinjet" gas scrubber is said to provide a high-efficiency scrubbing action with low operating and maintenance costs. Both single and multiple impingment plate units are offered. Scrubbing is accomplished by the turbulent interaction of gas and liquid as effected by the stainless-steel impingment baffle plate.

The single-stage scrubber handles dust loadings at inlet of up to 100 grains per cu ft. And it can remove suspended materials in a gas stream that range from submicron fumes to dust particles in the larger micron sizes, with efficiency in excess of 99% on many types of dust.

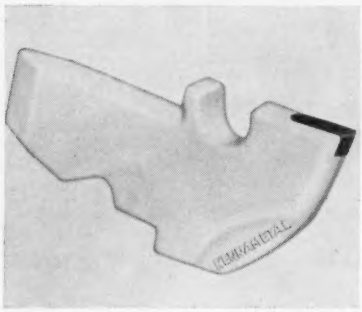


Hydraulic Dozers

A new hydraulic system for all blades used on the Euclid Model C-6 tractor (photo) has been announced by Euclid Div., General Motors, Hudson, Ohio, and Gar Wood Industries, Wayne, Mich. Designed to meet speed requirements of the Torqmatic Drive C-6, this hydraulic package consists of a single cylinder and a variable-volume piston pump known as the Gar Wood Variacs.

The Variacs pump provides a number of advantages important in crawler-tractor application. It delivers oil only when needed for raising and lowering the blade . . . no oil circulates in the hold position. When the blade load exceeds system capacity, the pump stops delivery of oil and automatically goes into hold position.

The single-cylinder design features faster blade speed and lifting power up to 7 tons greater than other dual-cylinder dozer mountings. Better tractor balance and improved operator visibility are also featured. Easily-operated controls are completely power-actuated.



Cutter Bit Designed With Dual-Gage Shoulder

Kennametal Inc., Mining Tool Div., Bedford, Pa., has announced its "U21" cutter bit with dual-gage shoulder design and rigid dimensional control. Dual-gage shoulders provide front and rear bearing areas able to absorb the severest shock forces. A pull-out notch permits easy, quick and safe extraction of tools from blocks on ripper-type chains. Close dimensional tolerances mean a close fit, assuring bit stability in the block and positive cutting action. These tight-fitting bits also minimize pounding or deformation of the tool holders, lessen flexing and lengthen life of rubber keepers. Three standard tip styles are offered.

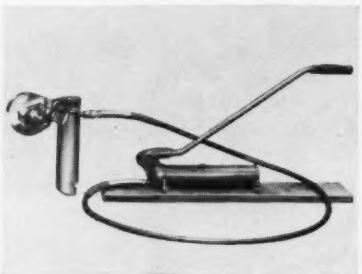
Blaster and Timer Measure Strata Depths

A new "Blaster" used in conjunction with the new "Seismic Timer" determines depth of underground rock formations without drilling a hole or excavating.

The battery-operated 4x7-in blaster, with seismic blasting caps, has a built-in circuit tester, ready light and positive, three-switch safety feature. It is a capacitor-discharge type, good for thousands of shots without battery replacement.

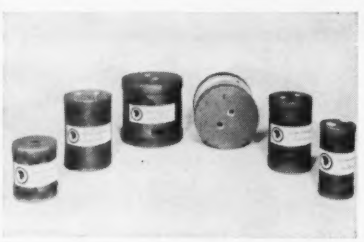
Used alone, the Model 117 "Seismic Timer" measures bedrock depths up to 100 ft or more. Velocity of seismic shock waves is measured and the time recorded directly in milliseconds, thus reducing chance for operator error. Waves are usually produced by a sledge striking a steel plate.

Both instruments are manufactured by DynaMetric, Inc., 2955 E. Colorado Blvd., Pasadena, Calif.



Cutting Cable With Ease

Combining hydraulic power with Porter Metal Cutters, the new 1790TN Porter Hand-Hydraulic Notched Shear Cutter provide quick, easy, safe positive cutting of ¾-in cable, wire rope and stranded guy wire. Cuts can be made overhead, on the ground or in confined areas. Cutting edges pass each other for complete shear action and jaws are notched to lock cable in during cut and to minimize crushing or deforming. A remote control, hand-hydraulic pump powers the cutting action by forcing hydraulic fluid through a high-pressure hose to the ram assembly and delivering 25,000 psi on cutting edges of blades. Since these cutters are completely independent of outside power sources, they may be taken to the job wherever it is. Two other models for cutting different materials are offered. For complete information, write H. K. Porter, Inc., 74 Foley St., Somerville, Mass.



Powerful Primer

Trojan Primers contain cast pentolite, an extremely dense explosive, that is entirely impervious to water. This explosive will not freeze in low temperatures, cannot exude or leak when stored under unfavorable conditions and contains no nitroglycerine to produce "dynamite" headaches. Though more powerful than any type nitroglycerine gelatin made, it has the same safety characteristics as

Hold fast in mine roof

To:
Mr. Charles Maynard
Mine #3

Chuck:

This is the shell I talked to you about last week at the mine. Roof bolting is right up O-B's alley... they pioneered the use of expansion units... probably know more about them than anyone in the field. I suggest you get in touch with their local sales engineer. I've found Ohio Brass people are glad to work right with you in the mine.

Regards.
Jack

Ohio Brass 4-Way Expanding Anchors hold in both soft shale and hard rock

- **GO UP FAST** . . . 4-way expansion begins with the first turn of the wrench.
- **DEVELOP TOP HOLDING POWER** with easy wrenching effort . . . 150 "foot pounds" of torque gives bolt tensions of 9000 pounds.
- **WORK IN CLOSE QUARTERS** . . . O-B engineers developed these anchors underground. Personal knowledge of mining problems enabled them to design units that are especially suited to your needs.
- **GET SERVICE** for your roof bolting problems . . . see your local Ohio Brass engineering representative or write Ohio Brass Company, Mansfield, Ohio.

O-B Bail Type Expansion Shell and Plug

Ohio Brass HOLAN

EXPANSION SHELLS AND PLUGS • LINE MATERIALS • SAFETY AND CONTROL EQUIPMENT • ELECTRIC HAULAGE MATERIALS

10044-M

NOLAN
Efficiency Products for Coal Mining

NOLAN

ROTARY CAR DUMPERS
Traction, Gear and Chain Drive

NOLAN

CAR FEEDER-RETARDER
Complete Trip Control Up or Down Grades
No Jerking—No Dog Wear

NOLAN

HYDRAULIC PORT-A-FEEDER
Simplified Electric and Reversing Control.
No Valves on Track Unit—Easy Change Dogs.

NOLAN

AUTOMATIC CAR LOADING STATION
Hydraulic—with Simplified Electrical Control. Mechanical—with EZ Tilt Pan.

NOLAN

HOLD-A-TRIP
Positive Trip Control—No More Skids for Down Grades—Adjustable Braking and Holding for All Conditions.

NOLAN

RERAILERS
Positive Cam Lock—Prevent Accidents
Light Weight—Easily Handled

WRITE FOR FREE CATALOG!

NOLAN
MINE CAR DUMPING AND CONTROL EQUIPMENT

NOLAN SALES AGENTS:

George C. Hutchinson, Jr., 800 Keenan Building, Pittsburgh, Pa.; Huntington Supply & Equipment Co., 423 First Huntington Nat'l Bank Bldg., Huntington, W. Va.; E. C. Horne Machinery Co., 1726 Champa Street, Denver 2, Colorado; Frank C. Memmott, P.O. Box 154, Castle Gate, Utah; J. L. Thomas, 429 South 24th Street, Birmingham 5, Alabama; John North Associates, P.O. Box 185, Norbert, Mich. (Chicago District); Levitt Safety Limited, Toronto 18, Canada.

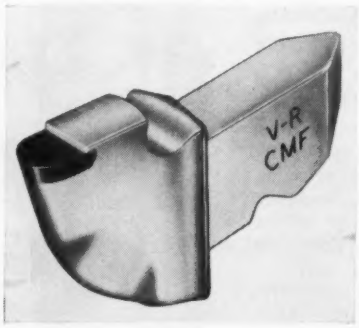
THE NOLAN COMPANY
116 Pennsylvania St. Bowerston, Ohio

Trojan Standard Explosives, reports Tojan Powder Co., 17 N. 7th St., Allentown, Pa.

Ratings Extended on Dustproof Capacitors

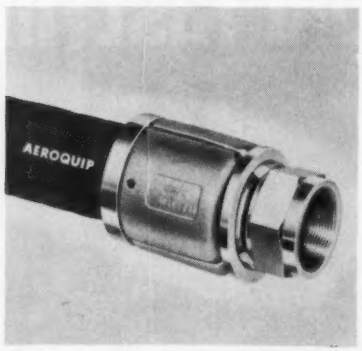
Ratings of industrial dustproof capacitors have been extended by Westinghouse Electric Corp. to 25 kvar from a previous high of 20. The new units are available for 480- and 600-V use, single or three phase. There is, however, no corresponding increase in size, weight or dimensions over the 20-kvar rating of the same voltage.

The individual units provide corrective capacity near the load when connected directly to machine terminals or at load centers. By switching through the motor or load-center controls, separate switches are not required. For further information, address the company at P. O. Box 2099, Pittsburgh 30, Pa.



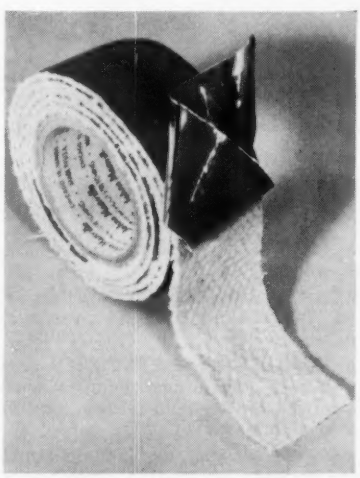
Free-Cutting Bit

A flat, full-width carbide tip is featured on the new V-R Style CMF Red Bit. Extremely good side clearance eliminates drag and gives fast, free-cutting action with minimum fines. A rigid lip design holds the carbide tip securely in the bit. The full, all-around collar which seats solidly on all sides, promotes uniform lug wear, increases retaining pin life and prevents carbide breakage. In addition, it keeps fines from packing in the lug. Vascoloy-Ramet Corp., 800 Market St., Waukegan, Ill.



Hose for High-Pressures Lines

Developed especially to meet the demand for large-diameter, high-pressure hose lines, "2755 Spiral Wrap" hose is said to be ideal for hydraulic systems where 1¼- to 2-in hose sizes are required with working pressures up to 3,000 psi. This hose has a synthetic inner tube with alternating layers of spiral wire wrapping and synthetic rubber. Leakproof and blowoffproof segmented fittings, developed for use with the hose, feature quick and easy assembly. And the hose need not be skived to attach fittings. Aeroquip Corp., Jackson, Mich.



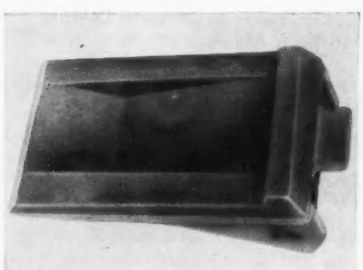
Adhesive-Backed Asbestos Tape

Called "Besto-Tak," this asbestos tape with a pressure-sensitive adhesive back-

ing offers many advantages in industrial applications where asbestos tape is needed for assembly purposes. The adhesive holds the tape in place while parts can be positioned or covers applied. Besto-Tak is available for services up to 500 F in commercial grades and up to 900 F in other grades. Its use in an unsupported structure, however, is limited to 275 F, point at which the adhesive begins to lose strength. The tape can be obtained in thickness of .022-, 1/32-, 1/16- and 1/8-in and in widths from 3/8 to 6 in. Tapes under 1/16-in thick are supplied in 50-ft rolls, others in 25-ft rolls. Thickness is nominal thickness of the tape, exclusive of adhesive. Johns-Manville, Packings & Textile Div., 22 E. 40th St., New York 16, N. Y.

Stronger Chain

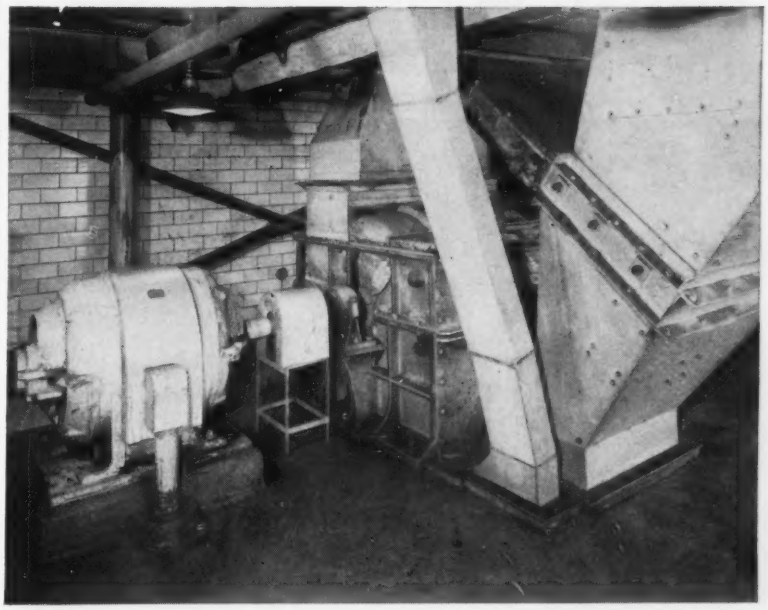
A redesign of the elements in the conventional roller chain has led to development of the "Bowman Chain" to produce a stronger chain, requiring less adjustment and maintenance. With essentially the same amount of material but more perfectly distributed, the new chain features: 40% fewer wearing surfaces; a reduction of 33⅓% in wearing parts; 39% greater bearing area and 66% more pin capacity. And, it can be turned over for extra wear life. Also, ultimate tensile strength or actual breaking load has been increased about 58%, reports Jeffrey Mfg. Co., Columbus, Ohio. It is recommended for use on hardened sprockets.



Bucket Tooth

Longer bucket life and proportionately less downtime for operators is claimed

CRUSHING FACTS



American "Rolling Ring" Coal Crusher

splits coal . . . smashes maintenance costs!

In almost five years, the above American Coal Crusher has reduced 1,800,000 tons of 2" x 0" coal to a ¾" x 0" product for a prominent midwestern utility. Since installation, this unit has handled an average annual tonnage of 450,000, with a very low ratio of replacement parts to tonnage. The operating engineer for this utility says, "We have experienced no stoppages . . . crusher operation and maintenance have been very satisfactory."

"Rolling Ring" design makes the difference. Specially designed rotor, consisting of four rows of patented shredder rings, each suspended on a single shaft, rotate freely at a relatively *slow speed.* Coal is *split* rather than smashed. This splitting action saves both power and maintenance, gives more uniform sizing, fewer fines. Rings can be reversed to give extended life.

American has manufactured reduction equipment since 1908 and you can be sure that "When you figure costs, the best results come from American *Rolling Ring* Crushers." If you have a coal preparation problem, why not write today for recommendations and literature. Our highly-trained engineering staff will give you prompt assistance.

American PULVERIZER COMPANY
ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS
1119 MACKLIND AVE. ST. LOUIS 10, MO.

How Aeroquip Hose and Reusable Fittings cut downtime

For Penn Coal & Coke Co., Ehrenfield, Pa.

Aeroquip Flexible Hose Lines are easily installed in tight places

Penn finds stock of Aeroquip Bulk Hose prevents downtime

A small stock of fittings serves all requirements

Miles Davis, Superintendent of Maintenance for Penn Coal & Coke Co., says, "We have tried other brands of hose and fittings and have always gone back to Aeroquip because of better results."

Like other coal field users, Mr. Davis finds that a small stock of Reusable Aeroquip Fittings and Bulk Hose economically supplies any replacement hydraulic, fuel and oil line needed for continuous miners, loaders and other equipment.

Dependable and rugged Aeroquip Hose Lines are easily assembled where and when needed.

Call your local Aeroquip Distributor today. He is listed in the Yellow Pages.

Bulk Aeroquip Hose can be cut to length and installed on the job without special tools. Fittings can be used again and again.

Aeroquip

AEROQUIP CORPORATION, JACKSON, MICHIGAN
INDUSTRIAL DIVISION, VAN WERT, OHIO
WESTERN DIVISION, BURBANK, CALIFORNIA
AEROQUIP (CANADA) LTD., TORONTO 19, ONT.

AEROQUIP PRODUCTS ARE PROTECTED BY PATENTS IN U.S.A. AND ABROAD

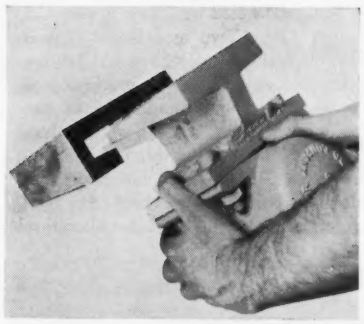
for the new ribbed tooth design by General Metals Corp., Watertown, Wis. The "8027 Dragon" tooth incorporates integrally-forged ribs on the outside tooth edges. This maintains straight cutting edges, prevents corners from wearing away and keeps a cutting edge almost to the point of complete destruction. A ledge at the back end of the tooth wear surface directs excavated material over the shank or adapter and erases rapid wear of the shank.

Two-Piece Cast Cement Plug

A two-piece cast cement plug reported to save time and expense of preparing tamping bags for large-diameter horizontal blast holes has been announced by Austin Powder Co., Cleveland 13, Ohio. The Austin "ATP Plug" consists of a cone and base loaded as a unit into the hole behind the explosive. To obtain maximum confinement, the solid cone is tamped into the base unit and thus seated solidly in the blast hole. No additional stemming is necessary. Different sizes are offered for holes from 4 to 10 in in diameter.

Detachable Light-Duty Electric Vibrator

A portable light-duty electric vibrator for moving materials from bins, hoppers, and trucks, can deliver an impact up to 275 lb and 3,600 vibrations per min, reports Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13, Ohio. Identified as the "RC-5 LSRR," this 40-lb vibrator attaches with a cast iron wedge and bracket to permit dismount-



ing. It can be lifted from its bracket mounting and moved wherever and whenever vibration is necessary. The bracket, which measures 4⅝-in in height and 7½-in in width, is welded to the side of the bin, hopper or truck. The RC-5 LSRR is offered for operation on 60-cycle, single- or three-phase current and 110, 220, 440 or 550 V.

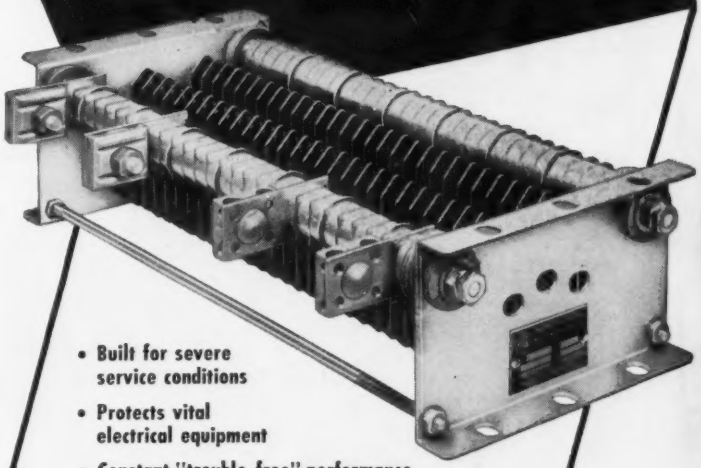
MAGNETIC PARTICLE TESTING—A complete new family of materials for the wet method of visible and fluorescent magnetic particle testing has been introduced by Magnaflux Corp., 7300 W. Lawrence Ave., Chicago, Ill. Most noteworthy feature of the "concentrates" is the ease with which a magnetic particle test bath can be prepared. Now the concentrates can be added directly to the oil and a uniform suspension is obtained almost immediately.

ROLLER SEALS—Metal-to-metal, cartridge-type track roller seals which increase the track roller lubrication interval to 1,000 hr are available for International TD-9 crawler tractors. The metal-to-metal sealing surfaces assure positive protection against lubrication leakage and entrance of abrasive foreign materials. Offered by International Harvester Co.'s Contruction Equipment Div., 180 N. Michigan Ave., Chicago 1, Ill.

GAS MASK CANISTERS—A 225% increase in moisture tolerance of its specially-designed All Service gas mask canisters has been reported by Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa. Use of a new desiccant and an improved Hopcalite—specifically prepared catalyst—made this increase possible. In addition, the improved canisters will retain this higher moisture-absorbing capacity through a wider range of temperatures. Windowcator and non-window Model S styles are available. The window-cator unit incorporates immediately visible indicating panels.

SCALES—Scales designed for laboratory or field weighing of aggregates samples

P-G Steel Grid Resistor
plays an *essential part*
in the production of COAL . . .

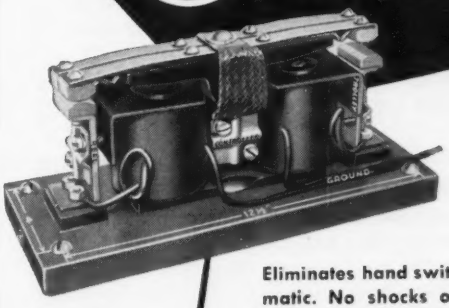


- Built for severe service conditions
- Protects vital electrical equipment
- Constant "trouble free" performance

These rugged nonbreakable units have proved their merit in all kinds of service for many years. Made of steel and mica, plus P-G unique and exclusive grid design, P-G Resistors are capable of protecting your most vital electrical equipment, even where service requirements are severe.

Designed to fit your present resistor space

P-G AUTOMATIC Transfer Switch



Single or double trolley and reel

Eliminates hand switches—entirely automatic. No shocks or burns to operator while changing from trolley to reel. Simple, safe, efficient, easy to install, can be mounted anywhere. For 250 to 600-volt service. Complete with cover.

P-G

THE POST-GLOVER ELECTRIC COMPANY
OFFICE and FACTORY—Kenton Lands Road, Erlanger, Kentucky
MAILING ADDRESS—Box 709, Covington, Kentucky

Model T-400 REICHdrill, designed especially for coring, has 12-foot continuous stroke. Down pressure to 10,000 pounds. Can drill up to 6" diameter holes, and take cores from more than 3,000 feet.

CORING—PROSPECTING...

you can be sure of FAST, SMOOTH operation

with a **REICHdrill!**

Experienced operators find the REICHdrill an ideal rig for coring and prospecting because:

- All-hydraulic drive to drill stem cuts power losses, transmission troubles . . . kelly and rotary tables are eliminated.
- Vari-speed Hydraulic Drill Control gives exactly the right combination of rotary speed and feed pressure for every formation . . . you literally feel your way down.
- Instant safety torque release protects all drive components, saves rotary and diamond bits, core barrels and drill steel.

Other important features: fast, easy set-ups; instant safety torque release to protect drive components and save rotary and diamond bits, core barrels and drill steel; special lever actuated mast insures maximum down-pressure directly over the rod . . . retracts hydraulically for fast core recovery with wire-line equipment.

You always get more from your rotary when it's a REICHdrill!

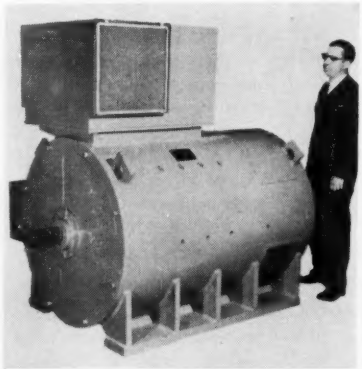
For further information write:

REICHdrill

FRANKLIN (VENANGO COUNTY), PENNA.

Division: CHICAGO PNEUMATIC TOOL CO.

are being marketed by Gilson Screen Co., Malinta, Ohio. Two models are offered, both of platform design with full capacity beams which are graduated in pounds, tenths and hundredths to simplify computations. They have a permanent tare weight adjustment, making them ideal for use with Gilson Testing Screens whose screen trays are independently removable and have uniform tare weight.



LARGER FRAME DESIGN—DC motors and generators, Type SK, frame diameter 190, with reduced inertia for faster response and increased mechanical stability for lower vibration, are now available from Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa. Ribbed construction at frame base given self-supporting prealigned rigidity while the use of brackets and ball bearing reduces weight and required floor space. Typical machine ratings are 500 hp at 850-rpm, 240-V dripproof enclosure, and 800 hp at 1,150-rpm, 600-V force-ventilated for heavy industrial applications. Corresponding generator ratings offered with dripproof construction are 480 kw at 850 rpm for 250-V DC power supply.

OIL-IMMERSED MOTOR CONTROL—General Electric Co., Schenectady 5, N. Y., has introduced a newly-designed 30-in-deep oil-immersed medium-voltage starter to its line of "Limitamp" motor controls. Designed for use in semihazardous locations, it places all normally arcing control components under oil. Major features include an oil-blast contactor rated 50,000-kva interrupting capacity and a highly-protective interlocking system enabling increased applications in semihazardous locations. This fused starter can be applied on systems of up to 250,000 kva available and will control up to 1,500 hp at 2,300 V and up to 3,000 hp at 4,160 V.

FOUR-WAY VALVE—A 1½-in four-way valve, rated at operating pressures to 5,000 psi is offered by Denison Engineering Div., American Brake Shoe Co., 1160 Dublin Rd., Columbus, Ohio.

Available as a thread, subplate or flange connected unit, the valve can be operated by manual, mechanical or electrical means. Five different spools provide for open, closed or partially blocked flow path connection at flows up to 90 gpm.

Equipment Shorts

Tube Coupling—A high-temperature, high-pressure rigid tube coupling with a superior seal has been announced by Resistoflex Corp., Roseland, N. J. Known as "Dynatube," it is said to maintain its seal under conditions of vibration, shock, pressure overloads, pulsing action or temperature variations.

Vibrators and Adapter—Branford Co., 130 Glen St., New Britain, Conn., has introduced two new "Vibrajust" pneumatic vibrators (1¼ in and 3 in) and their "Vibrajust" Impact-Frequency Adapter. This adapter gives full range control of the vibrator's frequency as well as impact control.

Shaft Seals—"Tak-Apart" seals feature a universal design that permits mass production for stock in catalog materials and sizes up to 4 in. They can be easily disassembled and reassembled by hand. Gits Bros Mfg. Co., 1866 S. Kilbourn Ave., Chicago 23, Ill.

Portable Engine Generator—The "Winco Super Mite," an 82-lb, portable engine generator offers an idling control —"Safeguarded Automatic Conserver"— that saves up to 60% in fuel cost, according to Wincharger Corp., Sioux City 3, Ia.

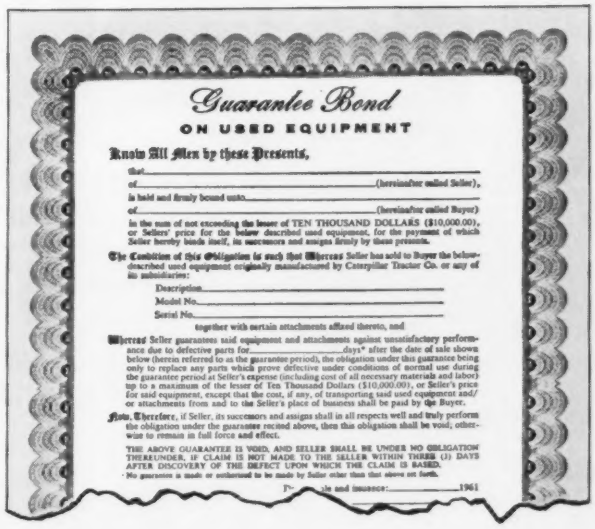
Portable Fabric Tanks—Created from finely-woven nylon fabric impregnated with a specially-compounded rubber, the new "Utility Tanks" range in capacity from 60 to 350 gal and are offered in eight "small" sizes. They represent an extension of the principle of "Pillow Tanks." A 350-gal size weighs only 50 lb when empty. Details from Goodyear Tire & Rubber Co., Akron 16, Ohio.

Cushion Coupling — For applications with high torque requirements, a heavy-duty flexible cushion coupling has been added to the Para-flex line of Dodge Mfg. Corp., Mishawaka, Ind. The PX280 coupling can handle 400 hp per 100 rpm and its capacity at maximum recommended speed of 910 rpm is 3,640 hp.

Free Bulletins

Cables — "Okonex Insulated Cables" is a 48-p reference manual just issued by Okonite Co., Passaic, N. J. Covers ca-

This Bond Is an Investment in You



Guarantee Bond

ON USED EQUIPMENT

Know All Men by these Presents,

that_____

of_____ (hereinafter called Seller),

is held and firmly bound unto_____

of_____ (hereinafter called Buyer)

in the sum of not exceeding the lesser of TEN THOUSAND DOLLARS ($10,000.00), or Sellers' price for the below described used equipment, for the payment of which Seller hereby binds itself, its successors and assigns firmly by these presents.

The Condition of this Obligation is such that Whereas Seller has sold to Buyer the below-described used equipment originally manufactured by Caterpillar Tractor Co. or any of its subsidiaries:

Description_____

Model No._____

Serial No._____

together with certain attachments affixed thereto, and

Whereas Seller guarantees said equipment and attachments against unsatisfactory performance due to defective parts for_____ days* after the date of sale shown below (herein referred to as the guarantee period), the obligation under this guarantee being only to replace any parts which prove defective under conditions of normal use during the guarantee period at Seller's expense (including cost of all necessary materials and labor) up to a maximum of the lesser of Ten Thousand Dollars ($10,000.00), or Seller's price for said equipment, except that the cost, if any, of transporting said used equipment and/or attachments from and to the Seller's place of business shall be paid by the Buyer.

Now, Therefore, if Seller, its successors and assigns shall in all respects well and truly perform the obligation under the guarantee recited above, then this obligation shall be void, otherwise to remain in full force and effect.

THE ABOVE GUARANTEE IS VOID, AND SELLER SHALL BE UNDER NO OBLIGATION THEREUNDER, IF CLAIM IS NOT MADE TO THE SELLER WITHIN THREE (3) DAYS AFTER DISCOVERY OF THE DEFECT UPON WHICH THE CLAIM IS BASED.

* No guarantee is made or authorized to be made by Seller other than that above set forth.

Executed and issued_____ 1961

Signed by your Caterpillar Dealer, this bond gives you up to $10,000 worth of machine dependability

Bonded Buy means guaranteed machine dependability. You can get a completely-checked, used Cat-built machine that has the Cat Dealer's confidence and guarantee, PLUS this bond from Lumbermens Mutual Casualty Company that backs up your machine with as much as $10,000 worth of parts and labor for the period you and the dealer agree upon.

See your dealer. Read the bond. Check the details. This guarantee can apply on your next used machine. And you pay no extra premium for this assurance. Dependable Bonded-Buy machines are priced right—and your Cat Dealer offers terms to match your needs. Call him or see him soon. Do business with the man whose business is built on dependability.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

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No cake scouring and no lumpy, uneven cake formation on discs with Eimco Agidisc filters. Exclusive "straight-up" agitation imparted by paddle agitator keeps fast-settling particles in suspension, results in improved dewatering and reduced costs.

The Eimco representative in your area will be glad to discuss the application of Agidisc filters in your operations. Ask him, too, about modern Eimco-Process equipment for clarification. Write Eimco Filter Division for bulletin FA-2032.

The EIMCO corporation
Head Office: Salt Lake City 10, Utah, U.S.A.
Export Office: 52 South St., N.Y.

"Advanced Engineering and Quality Craftsmanship Since 1884"

B-747

Agidisc is a trademark of The Eimco Corporation.

bles insulated with "Okonex" butyl-base high-voltage insulation and contains data on current-carrying capacities, dimensions and various designs.

Belt Conveyor Computations—Booklet covering a method for computing motor and belting requirements is offered by Goodman Mfg. Co, Halsted St. & 48th Pl., Chicago 9, Ill.

Percussion Bits — Complete line of carbide-tipped percussion bits for all types of rock drilling, quarrying and open-pit mining is covered in Catalog VR-500 from Vascoloy-Ramet Corp., Waukegan, Ill.

Parts Exchange Program—How swift replacement of machine components at only the cost of repair is the main advantage to equipment owners of the Parts Assembly Exchange Program offered by Caterpillar dealers is explained in "Avoid Delay the Modern Way." Write Advertising Div., Caterpillar Tractor Co., Peoria, Ill.

Tractor Equipment — Features and specifications of Allis-Chalmers crawler- and wheel-utility tractor equipment are offered in Specification Sheet UT-142. Contact the company's Utility Tractor Dept., Milwaukee 1, Wis.

Oral Resuscitator—"Venti-Breather," a simple and economical oral resuscitator that overcomes mouth-to-mouth contact in rescue breathing is covered in Bulletin 1100-4. Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.

Diesel Engines—Bulletin 125 covering applications of the Superior Model 40 diesel engines in shovels and draglines has been issued by Customer Service Dept., White Diesel Engine Div., White Motor Co., Springfield, Ohio.

Railway Equipment—For your copy of Catalog 10 covering Nolan's all-steel railway and industrial equipment, write Nolan Co., Bowerston, Ohio.

Bulk Materials Handling and Belt Conveyor Practice—Good belt conveyor practice for mining is the subject of "Mining Belt Conveyor Operation Maintenance Hints" available from Dept. OM, Hewitt-Robins, Stamford, Conn. Another Bulletin, No. 172 describes the company's trackside shakeout with complete pushbutton control. Address Dept. TC.

Bucket Elevator Systems—A new 84-p manual designed to simplify selection and application of bucket elevator systems for bulk handling of coal has been published by Webster Mfg., Inc., Tiffin, Ohio.

DIG UP NEW SERVICE LIFE RECORDS

retip with Amsco's "Pair for Wear"

Dipper teeth dig in and stay sharp when hardfaced and repaired with Amsco's newest electrodes. Both the Nicro Mang* and X-53—the "Pair for Wear"—will handle up to 90% of your hardfacing jobs where high impact and abrasion resistance are needed.

Nicro Mang replaces stainless steel and lets you weld manganese as easily as mild steel. It is a 14% manganese electrode with a deposit hardness of 175 BHN that work hardens to 500 BHN.

Its companion, the X-53, for all general hardfacing jobs, is as easy to run as Nicro Mang. It has a high deposit rate with no spatter and excellent bead characteristics.

Try this famous "Pair for Wear" on your dipper teeth. Leading welding distributors stock them in 50 lb. manual packages or 50 lb. semi-automatic coils. Or, write for your free sample kit containing both these hardfacing rods.

* TRADEMARK REGISTERED

661

AMERICAN Brake Shoe COMPANY

AMSCO

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS, ILLINOIS

Buy through your local welding supply distributor

Other plants in:
Denver • Los Angeles • New Castle, Del. • Oakland, Calif. • St. Louis
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Welding products distributed in Canada by Canadian Liquid Air Co., Ltd.

Meet Denis Plan the Hercules Technical Man who Pioneered the Introduction of Short-Period Delays in Southern Underground Coal Mining

It was back in early 1957 when Denis Plan, veteran Hercules technical representative, and several large mining operators conceived the idea of using Short-Period Delays in southern underground coal mines.

Extending over a period of several years, field trials in many underground mines in the southern coal fields proved that the use of Short-Period Delays resulted in:

Reduced vibration, concussion, and noise
Reduced damage to roof, ribs, and pillars
Produced more uniform fragmentation and less fines
Savings—fewer drill holes needed with reduction of explosives consumption
Quicker mining cycle
Safer operations—less exposure for shot-firer—less smoke and less disruption of ventilation

No Vent® Short-Period Delay Electric Blasting Caps are available in delay periods as recommended by the United States Bureau of Mines for coal mine blasting. Leg wires, with the most modern plastic insulation, are manufactured in a variety of lengths for all mining needs.

For complete information on how No Vent Short-Period Delay Electric Blasting Caps can be applied to your underground mining operation, call your Hercules representative or write direct to the office nearest you.

Explosives Department

HERCULES POWDER COMPANY
INCORPORATED

Hercules Tower
910 Market Street, Wilmington 99, Delaware

XR61-1

Birmingham, Alabama • Chicago, Illinois • Duluth, Minnesota • Joplin, Missouri • Los Angeles, California • New York, New York
Pittsburgh, Pennsylvania • Salt Lake City, Utah • San Francisco, California

Among the Manufacturers

Binder

Bigley

Centrifugal & Mechanical Industries, Inc. has announced a number of top-level personnel changes. Elmer O. Binder, formerly executive vice-president, has been elected chairman of the board of directors and president. Mr. Binder has been with the company since 1950 and during this period worked in a number of executive administrative positions. **P. W. Bigley** has been appointed executive vice-president and member of the board of directors. Formerly vice president — sales, Mr. Bigley joined the firm as sales engineer in 1945, was appointed sales manager in 1948 and vice president in 1959. **James E. Bilderback,** formerly sales manager, has been promoted to vice president — sales and elected a member of the CMI board of directors. The company also announced that **James C. Artrip** will direct sales and service activities in the Pittsburgh office and **Lucian C. Morrison** will have similar duties in the southeastern district with offices and warehouse at Huntington, W. Va.

Bilderback

Robert Burge has been named Columbus district manager, B. F. Goodrich Industrial Products Co. and will headquarter at 3770 Indianola Ave., Columbus 14, Ohio. His new responsibilities include sales of hose, belting and other industrial products in southern Ohio, Kentucky and most of West Virginia and Indiana.

John W. Carlson succeeds L. C. Daniels as general manager, Engine-Material Handling Div., Allis-Chalmers Mfg. Co. Formerly assistant general manager of the firm's Construction Machinery Div., Mr. Carlson had been president of the Tractomotive Corp., Deerfield, Ill., when that company was acquired by Allis-Chalmers in 1959. He then became general manager of the Deerfield Works. Mr. Daniels joined Allis-Chalmers in 1953 when it acquired the Buda Co., Harvey, Ill., where he had been a vice president since 1950. He will continue with Allis-Chalmers Mfg. in an advisory capacity.

John M. Macy has been appointed assistant to David M. Firth, vice president, engineering, Dodge Mfg. Corp., Mishawaka, Ind. In his new post, Mr. Macy will help direct an engineering program involving the manufacture of mechanical power transmission equipment. He joined Dodge in 1960 as a project engineer.

A. G. Gilbert has been named sales engineer, McNally Pittsburg Mfg. Corp., Chicago, Ill. He has 16 yr experience in coal preparation and particularly fine coal cleaning and water clarification. Previously he had been employed with Wilmot Engineering Co. as general sales manager and Heyl & Patterson, Inc. as manager of standard product sales.

Gilbert

Erwin Supply Co., Shinnston, W. Va., has been named a mining tool distributor for Carmet, the carbide-producing facility of Allegheny Ludlum Steel Corp. Erwin will service southwestern Pennsylvania, northwestern West Virginia and southern Ohio.

Baldwin-Lima-Hamilton Corp., Construction Equipment Div., Lima, Ohio, has appointed three new distributors for "Lima" shovels, cranes and draglines. They are **Euclid-Knoxville, Inc.,** Knoxville, Tenn., to cover the eastern part of Tennessee and northwest Georgia; **J & H Equipment Co.,** Wilmington, Ohio, to cover 15 counties in southwest Ohio; and **Euclid-Kentucky, Inc.,** Louisville, Ky., to cover most of Kentucky.

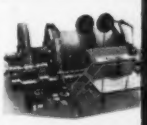
Directors of Ingersoll-Rand Co. and Aldrich Pump Co. have approved a proposal to consolidate the operations of the two companies. Ingersoll-Rand would expect to operate Aldrich Pump as a subsidiary and hopes to expand operations of the Allentown plant. Aldrich Pump is a leading producer of reciprocating pumps.

Long-Airdox Co. has centralized its principal sales, accounting, engineering, and purchasing functions at its Oak Hill, W. Va., headquarters. Although officials and key employees in the former Chicago office have transferred to Oak Hill, a western sales office will still be maintained at 307 N. Michigan Ave.

Vulcan
IRON WORKS CO.
IN DENVER SINCE 1891
2960 SOUTH FOX STREET
ENGLEWOOD, COLORADO

VULCAN
SLOPE ROLLERS
• Rubber or Neoprene
• REPLACEABLE Segments
• Sealed Ball Bearings
Cat. No. 117

VULCAN
MINE SHEAVES
• Cast Steel or Meehanite
• Flame Hardened Grooves or Replaceable Liners
Cat. No. 117



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MINE HOISTS
• Small, Medium or Large
• Single, Double or Divided Drum
Cat. No. AC 6002

VULCAN AUTOMATIC OR PUSH BUTTON OPERATED HOISTS
Now economical for production in small mines, or man service in large mines.
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SKIPS & CAGES
• Bottom Dump or Vertical Skips
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VULCAN
SLUSHER HOISTS
• 10-150 HP—Standard or Special Design
• Single, Double or Triple Drum
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Built-in air and waterlines remote control valve stations.
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Complete appraisal of coal-mining operations with special recommendations for reduction of production cost and increase of coal sales. Negotiations for purchase, lease or sale of mining properties.
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The advertising rate is $12.50 per inch for Equipment and Business Opportunity advertising appearing on other than a contract basis. Contract rates quoted on request.
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Send New Ads or Inquiries to Class. Adv. Div. of Coal Age, P.O. Box 12, N.Y. 36

FOR SALE

1—14BU9-3A Joy Loader, 26½" High, New Oct. '58 15 HP. Head & Traction Motors; REBUILT.
2—32E-16MX Shuttle Cars; MATCHED PAIR; 29½" High Elevating Discharge, Dual Tires, Completely Modernized, Airplane Brakes, Wet Clutch, Rotary Foot Switches, Over $10,000. Parts Thrown In.
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1—HM-834 GE Locomotive, ALL ROLLER BEARING, 42" Gauge, Being restored to new condition by GE Authorized Service Shop, Available 1 Month.
1—14BU-7CE, Low Pedestal Chassis Available, Sold As Is Disassembled, Sacrifice.
All Equipment 250V D.C., Photos Available.

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MANCHESTER, KENTUCKY
Phones: LY 8-5571 — LY 8-4542

100—ACF Rotary Dump Stub Axel All Steel Mine Cars
56½" Track Gauge
32" High—7' 0-¾" Wide—12'4" Bumper to Bumper
16" Wheels—Timken Roller Bearings
Capacity 114 Cu. Ft. Level Full
Excellent Condition.
PAGE COAL and COKE CO.
PAGETON, WEST VIRGINIA
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300KW Westinghouse Ignition Rectifier, 275 volts DC, 1952 Model, in excellent condition. Reasonable price.

W. Melvin Adams
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STRIP COAL WANTED
Lease or Purchase— large or small tracts. Morgan, Coal Company, 2850 North Meridian Street, Indianapolis 8, Indiana.

Quality Mining Machinery For Sale

CALL US FOR YOUR MINING NEEDS, WHETHER BUYING, SELLING, OR TRADING, YOUR CONFIDENCE KEEPS US IN BUSINESS. IF WE ADVERTISE IT—WE OWN IT.

A. C. MINING EQUIPMENT FOR SALE

1—12G-3 Goodman Cutting Machine, A.C.
2—11BU-10APH Joy Loading Machines, 220/440 Volts A.C.
2—4JCM Joy Continuous Miners, 440 Volts A.C.
3—7B Sullivan Cutting Machines, 220/440 Volts A.C.
1—35L Jeffrey Cutting Machine, 220 Volts A.C.
2—14BU Joy Loading Machines, 220/440 Volts AC.

LOADING MACHINES FOR SALE

1—14 BU-7RAE Joy Loading Machine, 250 Volts D.C.
1—18 HR Joy Loading Machine, 250 Volts D.C.
4—11 BU-10APE Joy Loading Machines, 250 Volts D.C.
1—14 BU-7BE Joy Loading Machine, 250 Volts D.C.
1—14 BU-3PE Joy Loading Machine, 250 Volts D.C.
5—12 BU-9E Joy Loading Machines, 250 Volts D.C.
4—8 BU Joy Loading Machines, 250 Volts D.C.
3—7 BU Joy Loading Machines, 250 Volts D.C.
2—Long 12″ Piggyback Conveyors, each 300′ long, complete with PT-12 Piggybacks and 12BU Joy Loading Machines.
2—14BU-7RBE Joy Loading Machines, 250 Volts, DC, excellent condition.

SHUTTLE CARS FOR SALE

3—10SC Joy Shuttle Cars, 500 Volts DC.
1—5SC Joy Shuttle Car, 250 Volts D.C.
2—6SC-7E Joy Shuttle Cars, Elevating Discharge, 4-Wheel Steering, 250 Volts D.C.
2—42E18 Joy Shuttle Cars, Disc Brakes, Elevating Discharge, Completely Modern, 250 Volts, D.C. 1-Standard, 1-Opposite Standard Drive.
2—6D-E Joy Shuttle Cars, 250 Volts D.C.
1—10SC-2P8XE Joy Shuttle Car, Permissible, equipped with 40J, 15 HP Motors.
4—10SC Joy Shuttle Cars, 250 Volts DC.

CUTTING MACHINES FOR SALE

1—512 EJH Goodman Cutting Machine, 250 Volts D.C.
2—29LC Jeffrey Cutting Machines, 250 Volts D.C.
2—10RU Joy Cutting Machines, 250 Volts D.C. with bugduster.
2—29UC Jeffrey Universal Cutters, Permissible, 250 Volts D.C.
1—512 CCH Goodman Cutting Machine, 250 Volts D.C.
4—35B Jeffrey Cutting Machines, 250 Volts D.C.
6—35BB Jeffrey Cutting Machines, 250 Volts D.C.
2—7AU Sullivan Cutting Machines, 250 Volts D.C.
5—35L Jeffrey Machine.
1—11RU Joy Cutting Machine, 250 Volts D.C.

CONTINUOUS MINERS FOR SALE

2—1CM Joy Continuous Miners, 250 Volts D.C.
3—4JCM Continuous Miners, 440 Volts A.C.
1—5 JCM Joy Continuous Miner with self-tramming and extensive belt, 440 Volt AC, complete with 1000 feet of structure and belting with bridge conveyor between miner and belt.

RECTIFIERS FOR SALE

1—400 KW American Selenium Rectifier, 4160 Volts Primary, 275 Volts D.C.

ROTARY CONVERTERS FOR SALE

1—300 KW Westinghouse, Pedestal Type Converter, 275 Volts D.C., Primary 2300/4000.
1—100 KW General Electric HCC-6 Rotary Converter, 1200 RPM, 2300/4000 Volts Primary, 275 Volts D.C., Pedestal Type.
1—200 KW General Electric HCC-6 Rotary Converter, 1200 RPM, 2300/4000 Volts Primary, 275 Volts D.C., Pedestal Type.

COAL DRILLS FOR SALE

25—CP-472 Electric Coal Drills, 250 Volts D.C.
5—CP-572 Coal Drills.
10—Chicago Pneumatic Little Giant 572 Coal Drills, 3 phase, 220 Volt A.C., permissible, New.

CRUSHERS FOR SALE

1—36″ x 36″ Double Roll Crusher, complete with 100 H. P. Motor.
1—Robins 36″ x 36″ Double Roll Stoker Crusher, specially built with spike teeth equipped with extra set of new segments.
1—Pennsylvania Single Roll Crusher, 24 x 40.

COMPRESSORS FOR SALE

2—Acme Self-propelled Air Compressors, 83R, Model 168, Capacity 176CFM, with 40 H.P. Reliance Compound Motor. Excellent Condition.

LOCOMOTIVES FOR SALE

1—MH-150 Jeffrey Locomotive, 42″ track gauge, 250 Volts D.C., 26½″ high, rebuilt.
1—General Electric 6 Ton Locomotive with Reel, 36″ gauge.
1—1030 Goodman Locomotive, 24″ high, 44″ track gauge.

ROCK DUSTERS FOR SALE

1—MSA Track Mounted Rock Duster, 10 H.P., A.C., or D.C., high pressure, 30″ high, any gauge.
2—MSA Bantam Rock Dusters, Rubber Tired, Portable.
2—MSA Bantam Rock Dusters, Skid Mounted.
1—American Mine Door, Wheel mounted bantam type rock duster, 250 Volts D.C., 22″ high.

HOISTS FOR SALE

1—Brownie Holst, 5 H.P., A.C.
6—#11½ Vulcan-Denver Material Hoists, Complete with 3 H.P. D.C. Compound Wound 1750 RPM General Electric Motor.
1—Brownie Hoist, Model HKO—Good condition.
2—Joy CHD Hoists, 10 H.P.

ELEVATORS FOR SALE

2—Joy PL11-16 Elevating Conveyors.

MACHINE TRUCKS FOR SALE

2—T2-5APE Joy Machine Trucks, 250 Volts, D. C.
1—T2-5APE Joy Machine Truck, AC.

CHAIN CONVEYORS FOR SALE

5—61AM Jeffrey Chain Conveyors, 10 H.P. 300′ long.
3—61HG Jeffrey Chain Conveyors, 5 H.P. 40′ long.
1—Jeffrey 300 ft. 15″ Chain Conveyor.
1—350 ft. LaDel Conveyor Line, complete.
1—300 ft. Joy Pans and Chains, complete.

DIESEL PLANTS FOR SALE

1—90KW Diesel Generator Set, 250 Volt D.C. with 671 General Motors Diesel Engine.
1—D13000 Caterpillar Diesel Generator Unit—with Caterpillar engine and 75 KVA G.E. generator self-regulating, 220 Volt A.C.
1—75KN Diesel Generator Set, 250 Volt D.C. with 671 General Motors Diesel Engine.

MOTOR GENERATORS FOR SALE

1—150 KW General Electric Motor Generator Set, 2300 Primary, 275 Volts D.C.
1—50 KW Westinghouse MG Set, 440 Volt, A.C., 250 Volt D.C.
1—300 KW Westinghouse Motor Generator Set, synchronous motor, 443 KW Output, 435 KVA, 2200 Volts, 1200 RPM. D.C. generator 300 KW, 275 Volts, 1200 RPM. Compound Wound. Complete with D.C. panel and switch gear.
3—50 KW G.E. and Westinghouse Motor Generator Sets, 2300 Volts A.C., 275 Volts D.C. Complete with switching gear.

BELT CONVEYORS FOR SALE

1—36″ Joy Self-Tramming Extensible Belt, 1200 ft. long with belt and drive.
1—30″ Joy Self-Tramming Extensible Belt, 1000 ft. long with belt and drive.
1000 ft. — 97-C Goodman 26″ Bell Structure.

ROOF BOLTING MACHINES FOR SALE

3—Fletcher Roof Bolting Machines; with permissible dust collectors.
1—Chicago Pneumatic RBD 30 Roof Drill.

THE FOLLOWING OFFERED AS A PACKAGE UNIT ONLY

1—5CM Joy Continuous Miner, 440 Volts A.C.
2—16SC Joy Shuttle Cars, matched pair, 440 Volts A.C.

MINE CARS FOR SALE

173—AC&F Drop Bottom Mine Cars, 42″ track gauge, 48″ high, 253 cubic feet.

MISCELLANEOUS FOR SALE

1—Compton Model 56 Auger with 300 H.P. Cummins Diesel Engine Drive, 210 feet 38″ diameter auger (6 sections—35 feet each); 1—42″ cutter head, 70 feet, 48″ diameter auger (2 sections—35 feet each); 1—52″ cutter head.
2—75 KVA Underground Transformers, Skid mounted 40″ high.
3—30 KVA Underground Transformers, skid mounted, 40″ high.
2—3 H.P. Gear Motors with 15″ head and tail assemblies.
2—5 H.P. Gear Motors with 15″ head and tail assemblies.
3—75 KVA Transformers, 2300/4000 Wye to 220 Volts.
3—35B Jeffrey Armatures, 250 Volts D.C.
4—902, 250 Volts D.C. Westinghouse Motor Units, only.
1—PL 11-14 Joy Elevator.
10—Goodman 512 Cutter Bars and Chains.
1—24″ Fan with drive.
2—7½ H.P. Tricycle Type Rubber Tired Mine Tractors, 7½ H.P. 220 Volt Single Phase Motors or 250 Volt D.C. Motors.
3—24 J Motors, 7½ H.P. 250 Volt D.C.
2—42″ Track Gauge Phillips Carriers.
1—Manson Mine Jeep 40″ Track Gauge equipped with 9J Motor.

ALL EQUIPMENT LISTED AND HUNDREDS OF OTHER ITEMS ARE IN STOCK AND MAY BE INSPECTED AT OUR SHOP AND EQUIPMENT YARD LOCATED AT RALEIGH, WEST VIRGINIA

MOUNTAIN STATE EQUIPMENT COMPANY

Box 1050, Beckley, West Virginia — **Phone CLifford 3-7383**

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Res. Phone CLifford 3-6804, Beckley

WILLIAM R. MONK
Res. Phone CLifford 3-6907, Beckley

R. E. KAMM
Res. Phone 4281, Summersville

ELECTRIC AND MACHINE SUPPLY COMPANY

Largest Supplier of the Best Rebuilt Mining Equipment

LOADING MACHINES

2—11BU Joy Loaders, 250 V. D.C.
5—8BU Joy Loaders, A.C. & D.C., rebuilt
1—14BU-7RAE Joy Loader, 250 V. D.C.
2—14BU-7RBE Joy Loaders, 250 V. D.C.
3—14BU-7BE Joy Loaders, 250 V. D.C.
3—14BU-3PE Joy Loaders, 250 V. D.C.
8—14BU-2E Joy Loaders, 250 V. D.C., 28" O.H.
3—12BU-9E Joy Loaders, 250 V. D.C., Permissible
3—20BU Joy Loaders, 250 V. D.C., Permissible
1—360 Goodman Loader, on rubber, 250 V. D.C.
6—Long 88 Pig Loaders, 250 V. D.C.
1—24BB Clarkson Loader, 250 V. D.C.
1—Eimco 21 Rock Loader

SHUTTLE CARS

5—60E-10 Joy Shuttle Cars, w/Elevators, matched pairs, 250 V. D.C.
9—42E Joy Shuttle Cars, 250 V. D.C.
5—5SC Joy Shuttle Cars, w/Elevators, 250 V. D.C.
17—6SC Joy Shutle Cars, matched pairs, 250 V. D.C.
2—8SC Joy Shuttle Cars, Elevating Discharge, Permissible Plates. Excellent condition, 250 V. D.C.
15—32E-10 & 32E-16 Joy Shuttle Cars, Excellent condition, 250 V. D.C.
3—32D Joy Shuttle Cars, complete w/batteries
2—MT66-A45 Jeffrey Shuttle Cars, 250 V. D.C., matched pair, permissible, Excellent condition

CONTINUOUS MINERS

1—3JCM Joy Continuous Miner, 250 V. D.C., Excellent Condition

CUTTING MACHINES

5—12RB Joy Cutting Machines, 250 V. D.C., Permissible, Dual Wheels, Bugdusters, 9' bar, Excellent Condition
5—11RU Joy Cutting Machines, 250 V. D.C., Permissible, Bugdusters, one completely rebuilt
1—70-URB Jeffrey Cutting Machine, 250 V. D.C., Excellent condition
1—29U Jeffrey Cutting Machine, 220/440 V. A.C., completely rebuilt, 36" t.g.
12—512 Goodman Cutting Machines, 250 V. D.C., Hydraulically or Manually controlled
1—824 Goodman Slabber, 250 V. D.C.
44—35B and 35BB Jeffrey Cutting Machines, A.C. and D.C.
5—7AU Sullivan Cutting Machines, 250 V. D.C.
6—7B Sullivan Cutting Machines, 250 V. D.C.
16—11B Sullivan Cutting Machines, 35 & 50 h.p., 250 V. D.C.
15—12AB, 12AA and 112AA Goodman Cutting Machines, 250 V. D.C.
5—212AA Baby Goodman Cutting Machines, 250 V. D.C.
1—712CJ Goodman Cutting Machine, 250 V. D.C.

BELT CONVEYORS

1—36" Joy Model "C" Belt Conveyor, 1,080' centers
6—MTB 30 Joy Tandem Belt Conveyors, 1,000' centers, 25, 40 & 50 h.p., one with Scandura Flame Proof Belting
1—30" 97HC Goodman Belt Conveyor, 1,000' centers with 25 h.p. Tandem Drive
4,280'—30" 99-5GT Goodman Belt Conveyor Structure
5—99-5GT Tandem Belt Conveyor Drives
1—30" Shop Constructed Belt Conveyor Drive
8,760'—26" Joy Model "C" Structure
18—26" Belt Conveyor Drives, various makes
1—26" MTB Joy Tandem Belt Conveyor, 1,000' centers

MISCELLANEOUS TRACKLESS EQUIPMENT

1—WK-83R Joy Compressor, 250 cu. ft.
1—WL-82 Joy Compressor, 125 cu. ft.
2—T2-5AE & T2-2E Joy Machine Trucks
2—T14G Joy Machine Trucks, 220 V. A.C.
1—Lot 9J, 10J, 23J, and 24J Motors

PREPARATION EQUIPMENT

1—4 Cell Jeffrey Baum Jig Washer, complete, 300 t.p.h. capacity
1—Simon Carver Heavy Duty 2 compartment Baum Jig, 400 t.p.h. capacity
1—Daniels Heavy Media Washer
1—48" CMI Centrifugal Dryer
1—Heat Dryer, complete
1—36" x 130' Hot Material Handling Belt, Excellent
4—7' x 15' Single Deck Diester Tables
1—36" x 33" Marion Double Roll Crusher
1—30" x 36" Jeffrey Double Roll Crusher, Like New
1—30" x 30" Link Belt Double Roll Crusher
1—24" x 50" Pa. Single Roll Crusher
3—24" x 24" Jeffrey Single Roll Crushers
1—2' x 4' Williams Pulverizer
1—18" x 24" McClanahan & Stone Single Roll Crusher
1—6' x 14' Single Deck Allis Chalmers Low Head Vibrator, Like New
1—5' x 12' Allis Chalmers Triple Deck Low Head Vibrator
1—5' x 12' Allis Chalmers Ripl-Flo Double Deck Vibrator
1—4' x 12' Hewitt Robbins Vibrex Screen, Triple Deck
5—4' x 7' Jeffrey Traylor Double Deck. Vibrators
2—4' x 7' Jeffrey Traylor Single Deck Vibrators
1—3' x 4' Single Deck Gyro Vibrator
1—3' x 8' Low Head Vibrator
1—30" x 72" Jeffrey Traylor Double Deck Vibrator
2—Magnetic Separators, complete
1—Set Jeffrey Dewatering Screens
4—Scraper Conveyors of various sizes
15—Drag Conveyors of various sizes
1—970' Jeffrey Rope and Button Conveyor
11—Boom Hoists from 1 ton to 5 ton
We can construct loading booms and tipple belt in any size.

CHAIN AND SHAKER CONVEYORS

20" Joy Chain Convevors, A.C. & D.C., Permissible
15" Chain Conveyor Drives, A.C. & D.C., Permissible
15" Long Chain Convevors, A.C. & D.C.
12" & 15" Jeffrey Chain Conveyors
12" Goodman Chain Convevors
PT12 Long Piggyback Conveyors
PT12-B Long Piggyback Conveyors
Goodman G12½, G15 & G20 Shaker Conveyor Drives
Joy Ladel UN17 Shaker Conveyor Drives
Goodman Power Duckbills & Duckbill Hoists

LOCOMOTIVE 250 V. D.C.

3—20 Ton Jeffrey MH77 Locomotives, 42" & 48" t.g.
1—15 Ton HM828 G.E. Locomotive, 90 h.p. units, 44" O.H., 48" t.g., Excellent
11—13 Ton Locomotives, 250 V., any gauge
1—12 Ton 29B Goodman Locomotive, 40" O.H.
10—10 Ton Locomotives, 250 V., any gauge
18—8 Ton Locomotives, 250 V., any gauge
28—6 Ton Locomotives, any gauge
4—6 Ton Jeffrey MH150 Locomotives
12—6 Ton MH88 Jeffrey Locomotives
11—5 Ton Locomotives, 250 V.
17—4 Ton Locomotives, 250 V., any gauge

BATTERY LOCOMOTIVES

5—7 Ton Atlas Locomotives
2—6 Ton Mancha Locomotives, 36" t.g., 47" O.H.
1—4 Ton G.E., 48" t.g.
1—4 Ton Mancha Locomotive, 48" t.g.
1—4 Ton Ironton Locomotive, complete w/charger, 44" t.g.

SUB STATIONS & TRANSFORMERS

1—300KW Westinghouse Stationary Rectifier, completely rebuilt
1—Westinghouse A.C. Sub Station, 4500KVA 6900/2300, complete w/boards, Excellent
3—300KW M.G. Sets
5—200KW M.G. Sets
3—200KW, HCC-6-1200 G.E. Rotary Converters, Automatic
2—150KW G.E. Rotary Converters, w/Transformers
1—150KW Westinghouse Rotary Converter, Completely Automatic
18—150KW M.G. Sets of various makes & voltages
2—100KW M.G. Sets
1—100KW Westinghouse Generator, 250 V. D.C., connected to Buda Diesel Engine, complete w/boards
2—100KW Generators, w/671 G.M. Diesel
1—90KW Generator, w/671 G.M. Diesel, Excellent
1—75KW Generator, w/10019 Diesel Engine
1—85KW Generator, w/75 h.p. G.M. Diesel w/ITE Automatic Control Board
1—100KVA Gasoline Alternator Unit
1—50KW M.G. Set, 125 V., D.C., 1200 rpm
2 Armatures for 200KW Rotary G.E., type HCC
2—600 & 800 Auto Transformers
166—Transformers from 1½KVA to 800KVA, list sent upon request.

MINE CARS

50—36" t.g. Phillips Clay Cars, 50" O.H., Excellent
40—36" t.g. Drop Bottom Cars
128—42" t.g. End Dump Cars, various makes
253—42" t.g. S. D. Drop Bottom Mine Cars
50—42" t.g. A.C.F. Drop Bottom Cars
140—44" t.g. Drop Bottom Cars, various sizes
456—44" t.g. End Dump Cars, various sizes
82—48" t.g. S. D. Drop Bottom Cars
259—48" t.g. A.C.F. Drop Bottom Cars
6—48" t.g. Man Trip Cars
2—56½" t.g., 3 ton, 4 wheel push trucks, New

RAIL AND WIRE

1,585 —Tons 30, 40, 56, 60, 70 & 100 lb Relaying Rail
400'—500,000 CM Bare Copper Feeder Cable
15,000'—2/0, 3 cond. Copper Cable. Insulated
37,600'—1/0 Solid Copper Highline Wire
15,000'—#1 Solid Copper Highline Wire
2,643'—#2 Stranded Copper Highline Wire
160,400'—#2 Solid Copper Highline Wire
1,595'—#4 Solid Copper Highline Wire
5,000'—2/0, 3 cond. Anhydrex & Lead Covered Transmission Cable
6,000'—4/0, 3 cond. Neonrene Jacketed Cable
1,800'—9 Section Figure 8 Trolley Wire
Several thousand feet #2, #3 and #4 approved type machine cable, 3 & 4 conductor

MISCELLANEOUS

1—TD9 International Hi-Lift
1—Canton Track Cleaner, Excellent
15—HKL, HKG, HKC, HL & CR Brown Fayro & Sullivan Hoists
49—Air Compressors of various sizes
57—Auto Starters from 3 h.p. to 100 h.p.
70—Hoists from 1½ to 800 h.p.
6—Shop constructed Jeeps, track mounted
7—Hydraulic Schroeder Coal Drills
93—Coal Drills, various makes and sizes
94—Pumps from ¾" to 4500 GPM
1—Pomona Deep Well Pump
1—14" Centrifugal Slurry Pump
33—Battery Chargers, various voltages
17,270'—Pipe: Galvanized, Plastic & Cast Iron
49—Room Blowers—Brown Fayro & Jeffrey
22—Mine Fans from 30" to 9' Hi Pressure
15—Rock Dusters up to 30 h.p.
3—Phillips Machine & Shuttle Car Carriers, 36" to 48" t.g.
1—42 Ton Richards Truck Scale, 10' x 25' deck
556—Stationary Motors—½ to 800 h.p., A.C. and D.C. (List of motors available upon request)
11,200'—3" Plastic Pipe
800'—4" Plastic Pipe

ALL INQUIRIES WILL BE ANSWERED PROMPTLY

WHITESBURG, KENTUCKY
BOX #610, Ph. #2223
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BILL CONLEY • MELVIN ADAMS
LEONARD NEASE • JACK FAIRCHILD

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BRONSTON CLAY

MOUNTAIN STATE EQUIPMENT COMPANY

HAS PURCHASED THE ST. ELLEN MINE OF PEABODY COAL COMPANY, O'FALLON, ILLINOIS, LOCATED ON U. S. ROUTE 50, APPROXIMATELY FIFTEEN MILES EAST OF ST. LOUIS, MISSOURI. THE ENTIRE STOCK OF EQUIPMENT AND APPROXIMATELY 400 ACRES OF LAND ARE BEING OFFERED FOR SALE AT BARGAIN PRICES.

J. J. MAHONEY AND ROY FAIRCHILD CAN BE CONTACTED AT MINE SITE AT ALL TIMES.

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O'Fallon
Illinois

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MErcury 2-3622
MErcury 2-3623
Night Phone: MErcury 2-5881
EX 7-2033
Belleville, Ill.

THE FOLLOWING IS A PARTIAL LISTING OF EQUIPMENT FOR SALE AT THE MINE SITE

SHUTTLE CARS, 250 VOLTS DC

8—Joy 10SC Shuttle Cars, right and left hand drive.
3—Joy 42-D Battery Shuttle Cars complete with batteries and chargers.
2—60E-10 Joy Shuttle Cars, 250 Volts DC, Disc Brakes, Elevating Discharge, completely modern, in excellent condition. Matched Pair.
2—10SC-1F Joy Shuttle Cars, 500 Volt DC, completely modern, excellent condition.

CUTTING MACHINES, 250 VOLTS DC

4—10RU Joy Cutting Machines
5—324 AA Goodman Slabbers—Track Gauge 42"

CONTINUOUS MINERS

2—Goodman Type 402 Continuous boring machine, 250 V. D.C. Serial #524 and #536 USBM permissible. Complete with new parts inventory and spare assemblies. Excellent modern machinery.

TROLLEY LOCOMOTIVES, 42" TRACK GAUGE FOR 250 VOLTS DC

1—13 ton Goodman — Type 81A04T, completely modern
1—Goodman 13 ton 136B-0-4-6 with 2—75 H.P. Motors
2—13 ton Jeffrey Locomotives, (1—inside frame and 1—outside frame)
1—Goodman 5 ton 3013 with 1—50 H.P. Motor.
4—8 ton 132AK42-48R Goodman with 2—50 H.P. Motors with reels.
1—8 ton 32-0-4-T Goodman with 2—50 H.P. Motors with reels.
1—8 ton LM2-8.DD General Electric with 2—50 H.P. Motors with reel.
2—6 ton LM2-T-6MM General Electric with 2—35 H.P. Motors with reel.
2—6 ton LM2-T-6MM General Electric with 2—35 H.P. Motors with reel.

BATTERY LOCOMOTIVES, 42" TRACK GAUGE

3—Greensburg Monitors complete with charging equipment and batteries.

LOADING MACHINES, 250 VOLTS DC

7—11BU Joy Loading Machines, completely modern with separate pump motors.
6—360 Goodman Loading Machines.
2—14BU-7BG Joy Loading Machines, 220 Volts AC, Excellent condition.
1—14BU-7CE Joy Loading Machine, 250 Volts DC, Excellent Condition.

MOTOR GENERATOR SETS

1—General Electric 300 KW Motor Generator Set, 1200 RPM, primary voltage 2300/4160, 275 Volts DC Complete with panel boards.
1—Westinghouse 200 KW Motor Generator Sets, 1200 RPM, 2300/4160 primary voltage, 275 primary voltage 2300, 1200 RPM, 275 Volts DC Complete with panel boards.
1—Westinghouse 150 KW Motor Generator Set, 1200 RPM, 2300 primary voltage, 275 Volts, DC, complete with panel boards.

ELEVATING CONVEYORS

3—PL11-16RPE Joy Elevating Conveyors—Straight dump.
3—PL11-16RPE Joy Elevating Conveyors—Converted to side dump.

BELT CONVEYORS

1—Barber Green 36" Lattice Frame Conveyor complete with belt and 15 h.p. 220/440 volt AC drive. Excellent.
1—Barber Green 36" Stacker Conveyor complete with belt, 25 h.p. 220/440 volt drive, 60 ft. long; including "A" Frame and electronic hoist.
1000—ft. Ajax Raynile #130, 42" wide conveyor belt, 1/4" top cover 1/16" bottom cover, 6 ply, with nylon breaker. Excellent condition.

MINE CARS

57—American Car & Foundry 3 door drop bottom mine cars, 18'3¼" overall length, 6' 10" wide, 34" overall height without 10" factory sideboard. 42" track gauge.

WIRE CABLE MATERIAL

1680 ft.—1/0 Solid Insulated.
1980 ft.—Stranded Bare
600 ft.—#12 Neoprene Cable
1900 ft.—#12 Stranded Single
495 ft.—1/0 three conductor 5000 Volt rubber covered cable w/ground.
7000 ft.—2/0 three conductor 2300 Volt rubber covered bore hole cable.
3000 ft.—4/0 three conductor 5000 Volt trench cable.
4000 ft.—2/0 three conductor 5000 Volt trench cable.

Large inventory Trolley Clips, Bells, Trolley Frogs and Switches.

TRACK MATERIAL

100—Tons 60 lb. Relaying Rail. Excellent condition.
150—Tons 70 lb. Relaying Rail. Excellent condition.
100—Tons 90 lb. Relaying Rail. Excellent condition.
1000—40 lb. Steel Ties, 42" Track Gauge.
50—40 lb. Switches complete
50—60 lb. Switches complete
1—American Mine Door Automatic Electric Switch Throw complete. All types miscellaneous track material.

COMPLETE FOUR-TRACK TIPPLE CAPABLE OF HANDLING 10,000 TONS OF COAL PER DAY

Partial List of Major Items of Tipple:
Sizes of coal: from ¼ x 0 to 7 x 4" Block
CMI 48" Dryer—complete with motors, drives, belt, etc. screen cloth 1/16" opening, capacity 90 ton per hour.
5—8x6 Allis-Chalmers Centrifugal Pumps, complete with motors (4) breakers.
1—16x14 Allis-Chalmers Centrifugal Pump, complete with motor, starter, breakers.
1—Roberts & Schafer Eleptic Vibrator.
Consists of Belt & Chain Conveyors complete with motors, drives. 36" Belt also some 24x30" Belt.
1—Roberts & Schafer Air Dying Plant (specifications furnished on request)

TRACK CLEANERS

1—Canton Track Cleaner, 42" gauge. Excellent condition.

WELDERS

2—Lincoln 300 amp. MG type, DC.
2—Hobart 300 Amp. MG type, DC.
2—Guyan Resistance Bonders

AIR SHOOTING EQUIPMENT

4—Armstrong Coal Breakers, Model EB-301, equipped with 60 h.p. motors, either 220/440 volt AC or 250 volt DC, complete with auxiliary equipment and controls. Excellent condition.

PORTAFEEDER

1—Nolan Portafeeder complete. Excellent condition.

COAL DRILLS

5—Manson Trucks—10 H.P., DC Tram Motors on 4, 7½ H.P. DC Tram Motors on 1, Joy 9 J Motor with Reduction on 1. Each drill truck has 2 drill arms with 2 Chicago Pneumatic 580 Drills 7½ H.P., DC.
3—Manson Track Trucks, each truck with 2 drill arms & 2,580 Drills.
2—Manson Track Trucks, without drills.
9—Dooley Rubber Tired Drill Trucks, equipped with two arms and two 580 drill motors.
9—Chicago Pneumatic #572, 220 Volt AC Coal Drills.

ROOF DRILLS

1—Joy RBD-7 with 15 HP Reliance Permissible DC and mounted on Manson with 7½ H.P. Westinghouse on Rubber.
1—Jeffrey 56 R.D. with 15 H.P. Motor DC, arm is mounted on Manson Track Truck.
1—Dooley (Rubber Tired) Drill Truck, equipped with Vertical Drilling 580 Drill Motors.
1—Fletcher Roof Bolter complete with Dust Collector. Permissible, 250 Volts DC, like new.
1—American Mine Door Road Cleaner
2—MSA Rock Dusters, 25 H.P. Track Permissible

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4—(Shop Built) Mobile Repair Trucks
3—Personnel Jeeps, 42" Track Gauge.

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2—Westinghouse, type 907, 10 ton, 44″ & 48″ ga.
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2—Goodman 865 Loaders, 26″, on Crawlers.
1—Goodman 665 Loader, on Crawlers, rebuilt.
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1—Goodman 660 Loader, on Crawlers, 250 V. D.C.
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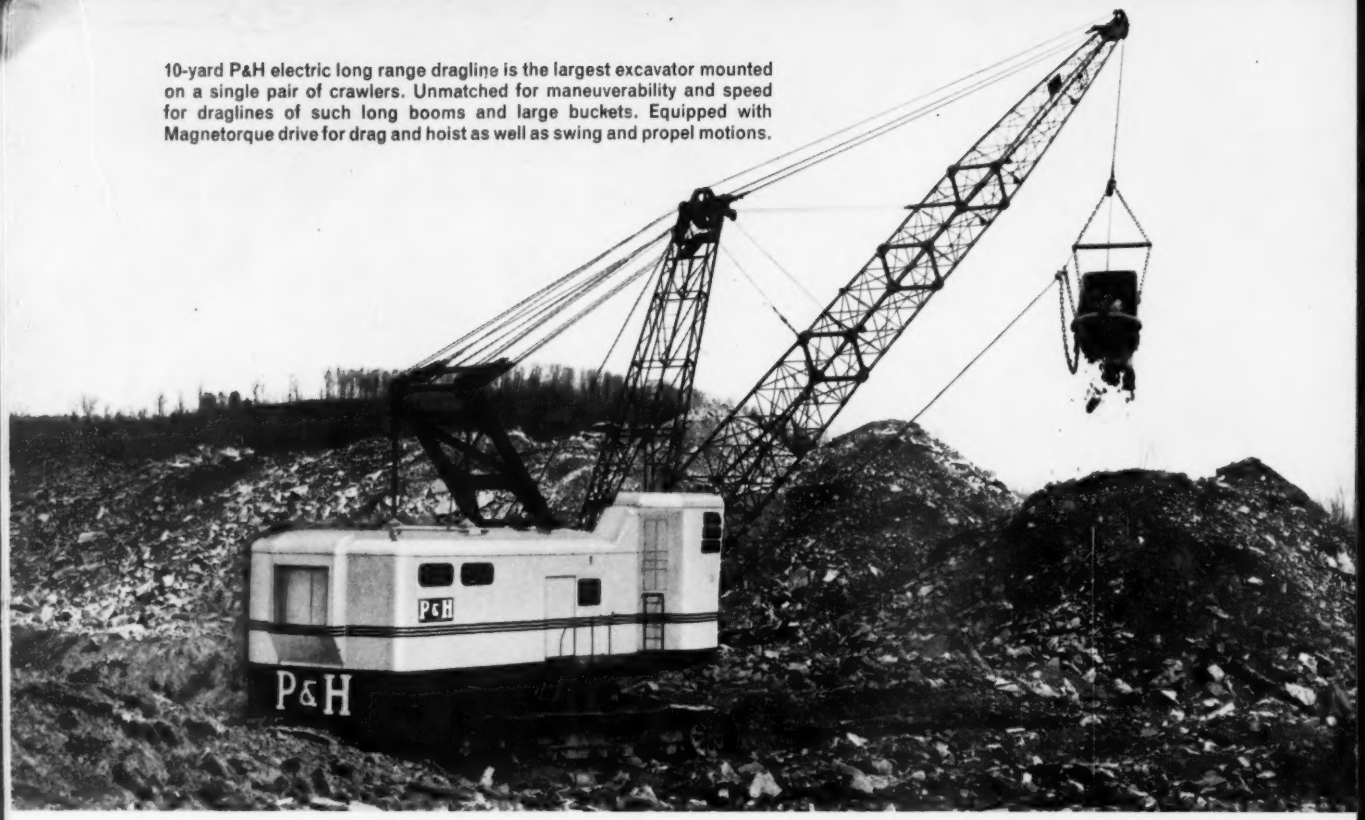

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